BARRY M. GOLDWATER RANGE

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

INRMP UPDATE

August 2018

Prepared for:
U.S. Department of the Air Force, Luke Air Force Base
U.S. Department of the Navy, U.S. Marine Corps, Marine Corps Air Station Yuma

In cooperation with:
U.S. Department of the Interior, Fish and Wildlife Service,
Cabeza Prieta National Wildlife Refuge
and
Arizona Game and Fish Department

Prepared by:
Colorado State University
Center for Environmental Management of Military Lands

U. S. Air Force
Integrated Natural Resource Management Plan 2018 Update
Barry M. Goldwater Range (BMGR)
Arizona

ABOUT THIS PLAN

This installation-specific Environmental Management Plan (EMP) is based on the U.S. Air Force's (USAF) standardized Integrated Natural Resources Management Plan (INRMP) template. This INRMP has been developed according to the Sikes Act Improvement Act (16 U.S. Code § 670 et seq., as amended through 2014) in cooperation with applicable stakeholders, which may include cooperating agencies and/or local equivalents, to document how natural resources will be managed. Non-U.S. territories will comply with applicable Final Governing Standards (FGS). Where applicable, external resources, including Air Force Instructions (AFI); Air Force Manuals (AFMAN); Marine Corps Orders; USAF Playbooks; United States Marine Corps (USMC) Handbooks; and federal, state, local, FGS, biological opinions, and permit requirements, are referenced.

The Barry M. Goldwater Range (BMGR) is unique in that management of the range is shared between the USAF and USMC. Whereas this 2018 INRMP follows the USAF standardized template, USMC-specific policies have been incorporated and the plan adheres to Marine Corps Order (MCO) 5090.2 of the *Environmental Compliance and Protection Program* (USMC 2018).

Certain sections of the USAF INRMP template begin with standardized, USAF-wide "common text" language that addresses USAF and Department of Defense policies and federal requirements. For USAF INRMPs this common text language is restricted from editing to ensure that it remains standard throughout all plans. Due to the joint management of the BMGR this text has been edited to include USMC language as appropriate.

NOTE: The terms "Natural Resources Manager," "NRM," and "NRM/POC" are used throughout this document to refer to the installation person responsible for the natural resources program, regardless of whether this person meets the qualifications within the definition of a natural resources management professional in DoDI 4715.03, Natural Resources Conservation Program*.*

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DOCUMENT CONTROL

Standardized INRMP Template

In accordance with (IAW) the Air Force Civil Engineer Center (AFCEC) Environmental Directorate (CZ) Business Rule (BR) 08, *EMP Review, Update, and Maintenance*, the standard content in this INRMP template is reviewed periodically, updated as appropriate, and approved by the Natural Resources Subject Matter Expert (SME).

This version of the template is current as of 06/26/2020 and supersedes the 2018 version.

Installation INRMP

Record of Review – The INRMP is updated no less than annually, or as changes to natural resource management and conservation practices occur, including those driven by changes in applicable regulations. IAW the Sikes Act, AFMAN 32-7003, *Environmental Conservation*, and MCO 5090.2 *Environmental Compliance and Protection Program* the INRMP is required to be reviewed for operation and effect no less than every five years. An INRMP is considered compliant with the Sikes Act if it has been approved in writing by the appropriate representative from each cooperating agency within the past five years. Approval of a new or revised INRMP is documented by signature on a signature page signed by the Installation Commander (or designee), and a designated representative of the United States Fish and Wildlife Service (USFWS), state fish and wildlife agency, and National Oceanic and Atmospheric Administration (NOAA) Fisheries when applicable (AFMAN 32-7003).

Annual reviews and updates are accomplished by the installation Natural Resources Manager (NRM), and/or a Section Natural Resources Media Manager. The installation shall establish and maintain regular communications with the appropriate federal and state agencies. At a minimum, the installation NRM (with assistance as appropriate from the Section Natural Resources Media Manager) conducts an annual review of the INRMP in coordination with internal stakeholders and local representatives of USFWS, state fish and wildlife agency, and NOAA Fisheries, where applicable, and accomplishes pertinent updates. Installations will document the findings of the annual review in an Annual INRMP Review Summary. By signing the Annual INRMP Review Summary, the collaborating agency representative asserts concurrence with the findings. Any agreed updates are then made to the document, at a minimum updating the work plans.

During 2018 and 2019, the Air Force Civil Engineer Center (AFCEC) engaged the Colorado State University Center for Environmental Management of Military Lands (CSU CEMML) to assist USAF installations with meeting DoD requirements to include climate change assessments in their INRMPs (Agreement No W9128F-16-2-0020-0018). To accomplish this task, a CSU team of climate scientists, ecologists, environmental planners, military land managers, and engineers reviewed the BMGR INRMP, generated downscaled temperature and precipitation data for the BMGR to develop climate projections under two future emission scenarios, and used tools and models to assess impacts of future climate on the installation's natural resources (CEMML 2019). In 2020, the results of this climate change assessment were integrated with the relevant sections of this INRMP.

Annual updates to this plan were completed in in FY 2019 and 2020.

FIVE YEAR REVIEW AND UPDATE OF THE INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN 2018–2023

Barry M. Goldwater Range
Maricopa, Pima, and Yuma Counties, Arizona

APPROVAL

This five-year review and update of the Integrated Natural Resources Management Plan was prepared by the United States Air Force and the United States Marine Corps – Barry M. Goldwater Range in cooperation with the United States Department of Interior, Fish and Wildlife Service and the Arizona Game and Fish Department. The signature below indicates concurrence with and acceptance of the following document. This plan has been prepared pursuant to the Sikes Act Improvement Act of 1998 (U.S. Code § 670a et seq., as amended through 2014).

Todd D. Canterbury
Brigadier General, USAF
Commander, 56th Fighter Wing
Barry M. Goldwater Range, Arizona
Luke Air Force Base, AZ

Todd D Canterbury

Date: 24 Oct 18

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David A. Suggs
Colonel, USMC
Commanding Officer
Barry M. Goldwater Range, Arizona
Marine Corps Air Station Yuma, AZ

Date: 20181022

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Amy Lueders
Director, Southwest Region
U.S. Fish and Wildlife Service

Date: Oct. 8, 2018

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Ty E. Gray
Director
Arizona Game and Fish Department

Date: 8·23·18

EXECUTIVE SUMMARY

The Barry M. Goldwater Range (BMGR) in southwestern Arizona has served as a military training range since 1941. While federal agency responsibility for natural and cultural resources management has varied over previous years, the Military Lands Withdrawal Act (MLWA) of 1999 (Public Law 106-65) which renewed the approximately 1.7 million-acre military range, assigned this responsibility to the Secretaries of the Air Force and Navy for the eastern and western portions of the range, respectively. The U.S. Air Force (USAF) and U.S. Marine Corps (USMC), in partnership with the Department of the Interior (DOI) and the Arizona Game and Fish Department (AGFD), prepared an Integrated Natural Resources Management Plan (INRMP), in accordance with the MLWA; the Sikes Act Improvement Act (hereafter referred to as "Sikes Act") (16 U.S. Code § 670a et seq., as amended through 2014); the National Environmental Policy Act (NEPA) of 1969 (42 U.S. Code §§ 4321-4370h, as amended through 1992); and other applicable laws. As provided by the Sikes Act, INRMPs must be reviewed as to operation and effect on a regular basis, but no less often than every five years. This 2018 INRMP is the second update for the BMGR and is the product of a thorough review of the 2012 INRMP in accordance with the five-year review cycle provided by the Sikes Act and in accordance with other updating procedures provided by the Sikes Act and the MLWA.

In accordance with the MLWA, the review was facilitated by the preparation of a Public Report that provides a summary of current use and conditions that have occurred since the 2012 INRMP was implemented. The use and conditions assessment includes military use, natural and cultural management actions, public access, public outreach, and environmental remediation actions. This revised INRMP was updated in consideration of the findings of the Public Report and consultations with partner agencies and Native American tribes. This update identifies management and other agency responsibilities and provides summaries of both the historical and current military uses of the BMGR. It also evaluates the current conditions of natural resources and identifies public access opportunities.

The USAF and USMC included a preliminary list of projects planned for the next five years to encourage feedback from the public, partnering agencies and Native American tribes. The resulting final project list is the heart of the 2018 INRMP update. The projects planned by the USAF and USMC address the 17 management elements, which are continued from the 2007 INRMP. The 17 management elements are categorized into five general types of actions.

1. Resource management—includes continuing the implementation of the natural resources inventory and monitoring plans
2. Motorized access—includes some modifications of the existing road network to better meet management needs that have been identified in the past five years, as described in Chapter 4.0, and continuing efforts to direct the public to use roads remaining open to public access
3. Public use—includes several management elements for providing recreational opportunities while protecting resources
4. Manage realty—includes addressing the public utility and transportation corridors that pass through the range and managing new right-of-way requests

5. Perimeter land use—involves monitoring land uses beyond the range to prevent encroachment and working with other agencies in regional planning

Each planned USAF or USMC action is identified by federal fiscal year (FY) for which funding is requested, an estimate of the funding needed for project completion, the expected life span of the project in years, and potential partners (see Table 10-1 and Table 10-2 in Chapter 10). Implementation of this INRMP is subject to the availability of annual funding appropriated by Congress and none of the proposed projects or actions shall be interpreted to require obligations or payment of funds in violation of any applicable federal law, including the Anti-Deficiency Act of 1982 (31 U.S. Code § 1341).

CHAPTER 1 OVERVIEW AND SCOPE

This INRMP was developed to provide for effective management and protection of natural resources. It summarizes the natural resources present on the installation and outlines strategies to adequately manage those resources. Natural resources are valuable assets of the U.S. Air Force (USAF) and the U.S. Marine Corps (USMC). They provide the natural infrastructure needed for testing weapons and technology, as well as for training military personnel for deployment. Sound management of natural resources increases the effectiveness of USAF and USMC adaptability in all environments. The Department of Defense (DoD) has stewardship responsibility for the physical lands on which installations are located to ensure all natural resources are properly conserved, protected, and used in sustainable ways. The primary objective of an installation's natural resources program is to sustain, restore, and modernize natural infrastructure to ensure operational capability and no net loss in the capability of USAF lands to support the military mission of the installation. The plan outlines and assigns responsibilities for the management of natural resources, discusses related concerns, and provides program management elements that will help to maintain or improve the natural resources within the context of the installation's mission. The INRMP is intended for use by all installation personnel. The Sikes Act is the legal driver for the INRMP.

1.1 Purpose and Scope

The BMGR in southwestern Arizona is a U.S. military installation that encompasses approximately 1.7 million acres. The USAF and the USMC use the range for training military aircrews in the tactical execution of air-to-air and air-to-ground missions. To a lesser extent, the range is also used for other national defense purposes, most of which support or are associated with tactical air training. The USAF is the primary user of and managing agency for the eastern portion of the range, referred to as the BMGR East, and the USMC is the primary user of and managing agency for the western portion of the range, referred to as the BMGR West (Figure 1.1).

The BMGR is an essential national defense training area that produces the combat-ready aircrews needed to defend the nation and its interests for the USAF, USMC, U.S. Department of the Navy (USN), Air National Guard (ANG), Army National Guard (ARNG), and Air Force Reserve Command. The BMGR has been one of the nation's most productive military reservations for training tactical aircrews since World War II. As the nation's third largest military reservation, the BMGR has the training capabilities, capacities, and military air base support that provide the flexibility needed to sustain a major share of the country's aircrew training requirements now and into the foreseeable future.

The predominant use of the BMGR throughout its history has been to provide land and airspace for tactical air training. The Military Withdrawal Lands Act (MLWA) of 1999 (Public Law 106-65 [hereafter "MLWA of 1999"]), which superseded the MLWA of 1986 (Public Law 99-606) extends statutory authorization for the BMGR to October 2024 and continues the historical military purposes of the range. This act reserves the BMGR for use by the Secretaries of the Air Force and Navy for

- an armament and high-hazard testing area;
- training for aerial gunnery, rocketry, electronic warfare, and tactical maneuvering and air support; and
- equipment and tactics development and testing and other defense-related purposes

consistent with those specified in [Public Law 106-65 § 3031(a)(2)].

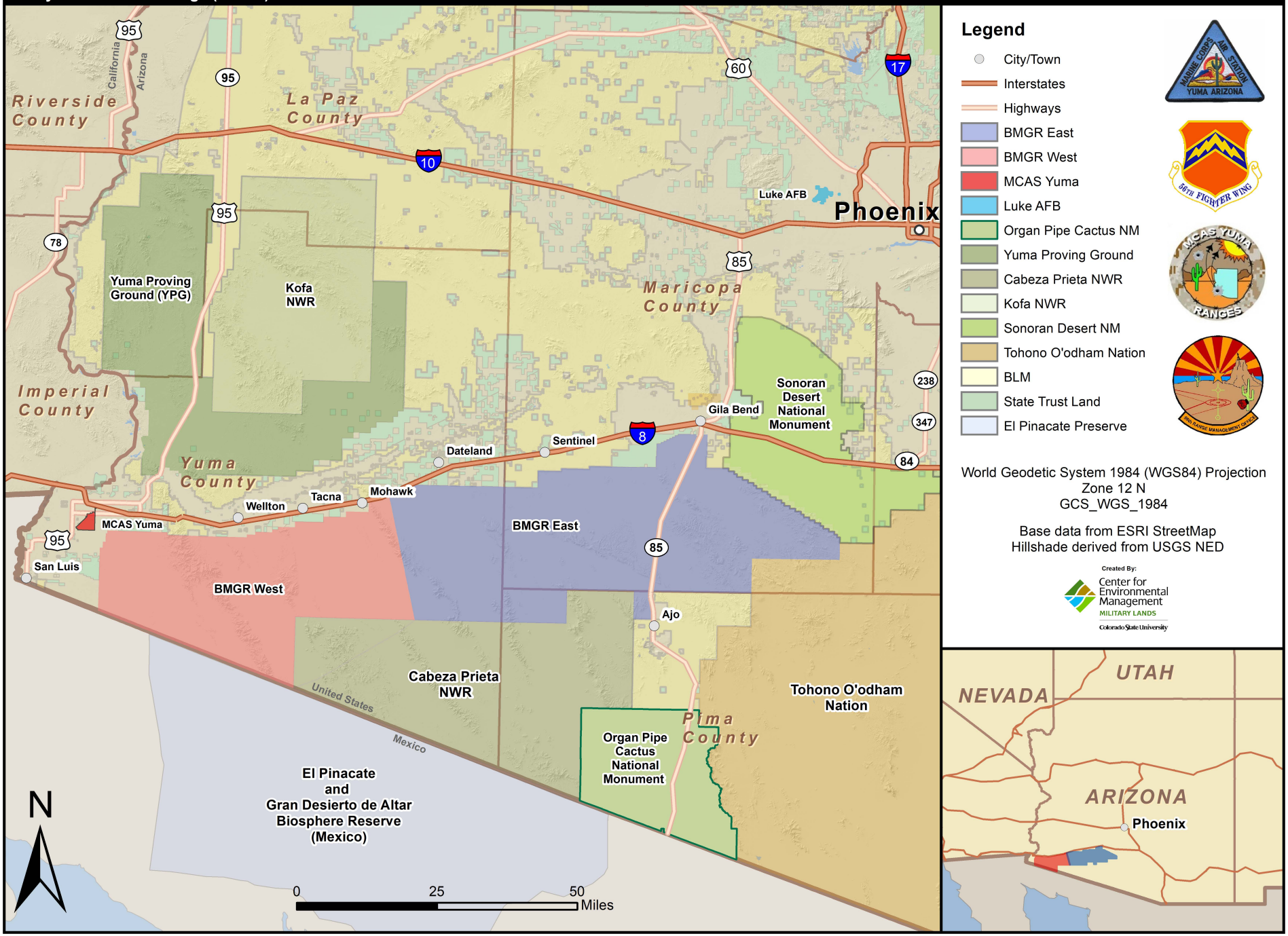
Parallel to its continuing value as an essential national defense asset, the BMGR is also nationally significant as a critical component in the largest remaining expanse of relatively unfragmented Sonoran Desert in the U.S. With the exception of State Route (SR) 85, the land is free of major developments and is ecologically linked to the Organ Pipe Cactus National Monument (NM), Cabeza Prieta National Wildlife Refuge (NWR), Sonoran Desert NM, and other lands administered by the U.S. Bureau of Land Management (BLM), as shown in Figure 1.1. Within this contiguous complex, the BMGR contributes almost 55 percent of the land area and is more than twice the size of any other component.

This INRMP is a comprehensive planning document that outlines the significant natural resources of the BMGR and allows for multiple sustainable uses of those resources. The INRMP defines public access while ensuring that management and use are consistent with the military purposes of the range. These purposes are in accordance with the guidance provided for the BMGR by the MLWA and for all U.S. military installations by the Sikes Act Improvement Act (16 U.S. Code [U.S.C.] § 670a et seq., as amended through 2014) (hereafter referred to as "Sikes Act"). Further, management prescribed by the INRMP benefits threatened and endangered species consistent with federal and state recovery actions for these species under the Endangered Species Act (ESA) of 1973 (16 U.S.C. § 1531 et seq., as amended through 1988).

Figure 1.1: General Location and Surrounding Land Ownership

Barry M. Goldwater Range (BMGR)

2018-2023 Integrated Natural Resource Management Plan (INRMP)



1.2 Management Philosophy

The USAF is the primary user of and managing agency for the BMGR East. Air Force Manual (AFMAN) 32-7003, *Environmental Conservation* (USAF 2020), provides the direction to implement Air Force Policy Directive 32-70, *Environmental Quality* (USAF 1994a), and DoD Instruction 4715.03, *Natural Resources Conservation Program* (DoD 2017a). AFMAN 32-7003 explains how to manage natural resources on USAF installations in accordance with applicable federal, state, and local laws and regulations. AFI 13-212, *Range Planning and Operations* (USAF 2015a), provides guidance on comprehensive range planning, including the integration of operational requirements and missions in preparation of INRMPs and ICRMPs. AFI 13-212 further provides that "Each INRMP and ICRMP will be written [in accordance with] AFMAN 32-7003 (USAF 2020) to support the current and future known mission requirements and will be amended as mission requirements change significantly."

The USMC is the primary user of and managing agency for the BMGR West. Guidance for the USMC INRMP process is provided in Marine Corps Order (MCO) 5090.2of the *Environmental Compliance and Protection Program* (USMC 2018), DoD Instruction 4715.03, and the *Handbook for Preparing, Revising, and Implementing Integrated Natural Resources Management Plans on Marine Corps Installations* (USMC 2004), hereafter referred to as the *Handbook*. This handbook guides the preparation, revision, and implementation of INRMPs in compliance with the Memorandum of Understanding (MOU) between the DoD, the U.S. Fish and Wildlife Service (USFWS), and the International Association of Fish and Wildlife Agencies and in accordance with the Sikes Act as implemented by the Office of the Secretary of Defense in *Updated Guidance on Implementation of the Sikes Act Improvement Act* (DoD 2002).

The DoD has modified its land management focus over the past two decades from the protection of individual species to ecosystem management. The two principal reasons for these changes are (1) the Sikes Act emphasis on promoting effective wildlife and habitat protection, conservation, and management; and (2) the concern that a disproportionate amount of attention in the past has been placed on managing the needs of individual, high-profile species in possible conflict with underlying ecosystem functions.

Ecosystem management incorporates the concepts of biological diversity and ecological integrity in a process that considers the environment as a complex system functioning as a whole, not as a collection of parts. In its application, a goal-driven approach is used to manage natural and cultural resources in a manner that supports present and future mission requirements; preserves ecosystem integrity; is at a scale compatible with natural processes; is cognizant of nature's timeframes; recognizes social and economic viability within functioning ecosystems; is adaptable to complex and changing requirements; and is realized through effective partnerships among private, local, state, tribal, and federal interests. Traditionally, academic disciplines such as ecology, biogeography, population genetics, economics, sociology, philosophy, and others are synthesized and applied to the maintenance of biological diversity. Because ecosystem management is based on ongoing studies of ecology, biological diversity, and resources management, and because ecosystems are open, changing, and complex, this planning and management philosophy requires flexibility. Provisions to

allow for adaptive management include monitoring, assessment, reassessment, and adjustment as necessary

DoD policy guidelines on ecosystem management are intended to promote and protect natural processes. Those guidelines, however, do not preclude active management intervention deemed necessary to address issues such as the removal of invasive species; supporting endangered species recovery or managing barriers to wildlife movement inside or outside of the installation. The DoD expects its resource managers to use the best available science, collaborative efforts with federal and state wildlife agencies, and consultations with outside experts and the public in reaching and implementing management decisions, including specific needs for intervention.

1.3 Authority

The MLWA of 1999 and the Sikes Act provide legal authority for the BMGR INRMP. The MLWA of 1999 provides that the Secretaries of the Navy, Air Force, and Interior jointly prepare an INRMP for the range. The INRMP shall "include provisions for proper management and protection of the natural and cultural resources of [the range], and for sustainable use by the public of such resources to the extent consistent with the military purposes [of the range]. . . ." (Table 1-1).

The MLWA of 1999 also specifies that the INRMP must be prepared and implemented in accordance with the Sikes Act. The Sikes Act sets forth resource management policies and guidance for U.S. military installations and requires the preparation of INRMPs for installations—including those, such as the BMGR, composed of withdrawn lands—with significant natural resources (Table 1-1).

The Sikes Act provides that "The Secretary of Defense shall carry out a program to provide for the conservation and rehabilitation of natural resources on military installations" and that an INRMP is to be prepared to facilitate implementation of that program. Consistent with the use of military installations to ensure the preparedness of the Armed Forces, the Sikes Act further specifies that the Secretaries of the military departments shall carry out a natural resources management program to provide for

- conservation and rehabilitation of natural resources on military installations;
- sustainable multipurpose use of the resources, which shall include hunting, fishing, trapping and non-consumptive uses; and
- public access—subject to safety requirements and military security—to military installations to facilitate use.

Table 1-1: INRMP elements specified in the Sikes Act and MLWA of 1999.

Sikes Act
To the extent appropriate and applicable, provide for the INRMP elements listed below. • Wildlife management, land management, and wildlife-oriented recreation • Wildlife habitat enhancement or modifications • Wetland protection, enhancement, and restoration, where necessary for support of wildlife or plants • Integration of, and consistency among, the various activities conducted under the plan • Establishment of specific natural resources goals and objectives and time frames for proposed actions • Sustainable use by the public of natural resources to the extent that the use is not inconsistent with the needs of wildlife resources • Appropriate public access, subject to requirements necessary to ensure safety and military security • Enforcement of applicable natural resource laws (including regulations) • No net loss in the capability of military installation lands to support the military mission of the BMGR
MLWA of 1999
The INRMP shall include the provisions listed below. • Provide for the proper management and protection of the natural and cultural resources of withdrawn lands. • Provide that any hunting be conducted in accordance with the provisions of 10 U.S.C. § 2671 (the general military policy for hunting, fishing, and trapping on military reservations). • Identify current BMGR test and target impact areas and related buffer or safety zones. • Provide necessary actions to prevent, suppress, and manage brush and range fires that occur within or outside the BMGR as a result of military activities. • Provide that all gates, fences, and barriers constructed are designed and erected to allow wildlife access to the extent practicable and consistent with military security, safety, and sound wildlife-management use. • Incorporate any existing management plans pertaining to the BMGR, to the extent that INRMP preparers mutually determine that incorporation of such plans into the INRMP is appropriate. • Include procedures to ensure that the periodic reviews of the plan under the Sikes Act are conducted jointly by the Secretaries of the Navy, USAF, and Interior, and that affected states, Native American tribes, and the public are provided a meaningful opportunity to comment upon any substantial revisions to the plan that may be proposed. • Provide procedures to amend the plan as necessary.

1.3.1 Agency Responsibilities

The MLWA of 1999 transferred federal jurisdiction for managing the natural and cultural resources of the BMGR from the Secretary of the Interior to the Secretaries of the USAF and Navy. However, the Secretary of the Interior retains some oversight responsibilities as well as a role in updating the INRMP. The Secretary of the USAF, who now has primary surface-management responsibility for the BMGR East, delegated local command and control for the BMGR East to the Commander of the 56th Fighter Wing (56 FW) at Luke Air Force Base (AFB). As a result, Luke AFB also assumes responsibility for preparing and implementing the INRMP for the BMGR East. Similarly, the Secretary of the Navy, who has primary surface-management responsibility for the BMGR West, delegated local command

and control for the BMGR West and responsibility for preparing and implementing the INRMP for that portion of the range to the Commanding Officer of Marine Corps Air Station (MCAS) Yuma. Therefore, the Commanders of Luke AFB and MCAS Yuma provide local command and control for military operations, public access and use, and resource-management activities on a daily basis for their respective portions of the BMGR.

Although the USAF and USMC hold the primary surface-management responsibility for the BMGR, the Secretary of the Interior and AGFD are responsible for its natural resources. The Secretary of the Interior was assigned a role by the MLWA of 1999 to assist the Secretaries of the USAF and Navy in jointly preparing the INRMP and conducting periodic reviews of the INRMP for updating the plan as necessary. This role has been delegated to the Manager of Cabeza Prieta NWR.

As provided by the MLWA of 1999, the Secretary of the Interior also has the authority to transfer land management responsibility for the BMGR from the USAF and/or USMC to the DOI if the Secretary determines that (1) the USAF or USMC has failed to manage natural and cultural resources in accordance with the INRMP, and (2) this failure is resulting in significant and verifiable degradation of the natural or cultural resources of the BMGR. Another provision of the MLWA of 1999 directs the USAF and/or USMC to consult with the DOI before using the BMGR for any purpose other than the purposes for which it was withdrawn and reserved. The Arizona State Director of the BLM has the local responsibility for representing the DOI in such oversight activities and consultations.

1.3.2 Arizona Game and Fish Department Authority

The state of Arizona has primary jurisdiction over wildlife management within the BMGR, except where pre-empted by federal law. Nothing in the MLWA of 1999 or Sikes Act either diminishes or expands the jurisdiction of the state with respect to wildlife management. In addition, AGFD is the responsible state agency for providing safe opportunities for off-highway vehicle (OHV) recreation in Arizona.

Established in 1929 under Title 17 of the Arizona Revised Statutes (ARS), AGFD is governed by the Arizona Game and Fish Commission. Under the provisions of ARS 17-231, the Arizona Game and Fish Commission establishes policy for the management, preservation, and harvest of wildlife. Under the umbrella of the Commission, the AGFD's mission is "To conserve, enhance, and restore Arizona's diverse wildlife resources and manage for safe, compatible outdoor recreation opportunities for current and future generations" (AGFD 2017a).

The primary wildlife management responsibilities of AGFD were recognized in the 2007 INRMP and continue without change to include

- developing and maintaining habitat assessment/evaluation, protection, management, and enhancement projects (e.g., artificial water developments and Sonoran pronghorn [*Antilocapra americana sonoriensis*] food plots);
- conducting wildlife population surveys;
- managing wildlife predators and endangered species or special status species (management of federally listed endangered species is a responsibility shared with the USFWS);
- enforcing hunting regulations;

- establishing game limits for hunting, trapping, and non-game species collection;
- issuing hunting permits; and
- assisting and advising the DoD to manage OHV use in terms of habitat protection and advocating for user opportunities.

In managing the state's wildlife, AGFD continues to make determinations on the appropriateness and need to transplant wildlife into or out of the BMGR. Should wildlife transplants affecting the BMGR be proposed, appropriate environmental studies and regulatory compliance would be completed, as required, prior to implementing any specific proposal.

1.3.3 U.S. Border Patrol Authority

The entire range is potentially subject to the presence of undocumented aliens (UDAs) and smuggling traffic because of its proximity to the international border (Figure 1.1). Therefore, the range is heavily patrolled by U.S. Customs & Border Protection (CBP) agents seeking to interdict and apprehend smugglers and illegal entrants. CBP is also charged with installing border infrastructure as needed to deter illegal crossings and maintaining operational control of the border (*Homeland Security Act of 2002*, P.L. 107-296, 6 U.S. C. §§ 101 et seq. [U.S. Department of Homeland Security 2002]; Section 102 of the *Illegal Immigration Reform and Immigrant Responsibility Act of 1996* (Public Law 104-208, as amended); 8 U.S.C. § 1103, *Aliens and Nationality*; and other acts). Within CBP, the U.S. Border Patrol (BP) is the delegated authority for "detecting and preventing the entry of terrorists, weapons of mass destruction, and unauthorized aliens into the country, and to interdict drug smugglers and other criminals between official points of entry." Within the BMGR East, the BP coordinates with Range Management Office (RMO) Conservation Law Enforcement Officers (CLEOs) and Pima and Maricopa County Sherriff Offices. Within the BMGR West, the BP coordinates with Range Management Department (RMD) CLEOs, Yuma County Sheriff's Office, and Yuma County Search and Rescue.

In January 2007, the Department of Homeland Security waived numerous environmental, natural and cultural resources conservation actions and endangered species protection laws in order to ensure the expeditious construction of the border fence along the international boundary within the BMGR and adjacent public lands (Federal Register 2007), (Sikes Act; MLWA; National Environmental Policy Act (NEPA) 42 U.S.C. § 4321 et seq.; ESA 16 U.S.C. § 1531 et seq.; Clean Water Act 33 U.S.C. § 1251 et seq.; Wilderness Act, 16 U.S.C. § 1131 et seq.; National Historic Preservation Act of 1966 16 U.S.C. § 470 et seq.; National Wildlife Refuge System Administration Act, 16 U.S.C. §§ 668dd-668ee; and Administrative Procedure Act 5 U.S.C. § 551 et seq.; Haddal et al. 2009).

1.4 Integration with Other Plans

"Mission requirements and priorities identified in [this INRMP] shall, where applicable, be integrated in other environmental programs and policies" (USMC 2004). Implementation of this INRMP will support and sustain the military mission of the range with no net loss in the capability of the BMGR lands to support the mission. The INRMP is incorporated (i.e., referenced as appropriate) into the BMGR East *Comprehensive Range Plan* (CRP, in prep.) and MCAS Yuma Range and Training Areas Standard Operating Procedures (SOP) Station Order 3710.6J (USMC 2014).

In accordance with the MLWA of 1999, the INRMP provides for protection of the cultural resources of BMGR by prescribing that natural resources management actions be fully supportive of and compliant with the prescriptions of the ICRMP for the range (see Section 7.14). INRMPs and ICRMPs for military installations are prepared as separate but integrated plans rather than as components of a single plan. The following ICRMP goals are also adopted as goals in the INRMP.

- Support military operations through proactive management of cultural resources.
- Fulfill legal obligations for protection of historic properties.
- Address Native American concerns, including disposition of cultural items.

AFI 13-212 requires USAF installations to review and coordinate all range-related documents, including INRMPs, ICRMPs, and subordinate plans to ensure compatibility with the CRP and other range plans. INRMPs often incorporate subordinate plans that address installation actions such as pest control or wildfire suppression. Furthermore, each INRMP and ICRMP shall be written to support the mission requirements identified in the CRP and shall be amended as mission requirements change significantly.

MCO 5090.2 (USMC 2018) requires that USMC INRMPs and the installation master plan shall identify the boundaries of endangered and threatened species habitat, wetlands, and other geographically specific areas important to natural resources stewardship. MCO 5090.2 also requires that the Wildland Fire Management Plan (WFMP) shall be incorporated into or consistent with the INRMP and ICRMP and that the Integrated Pest Management Plan (IPMP) is reviewed by the Natural Resources Manager for consistency with the INRMP.

Since the completion of the 2012 INRMP, several subordinate plans have been prepared and implemented. These plans, listed below, are referenced throughout this INRMP.

- CRP (East) (in prep.)
- Range and Training Area SOP (West) (USMC 2014)
- ICRMP (56th Range Management Office [56 RMO] 2009)
- IPMP (Luke AFB 2015)
- WFMP (In-progress both East and West)

1.5 Interagency Collaboration and Intergovernmental Consultation

A previously existing MOU that established the Barry M. Goldwater Range Executive Council (BEC) was amended in February 2001 for the purpose of "providing a forum for collaboration by the statutory decision makers in the management of resources and their uses. . . ." within the BMGR. The BEC, a local management ad hoc committee, consists of a local senior functional manager for the USAF, USMC, BLM, USFWS, AGFD, CBP, and directors for the adjacent Sonoran Desert NM, Organ Pipe Cactus NM, and Cabeza Prieta NWR. The USAF, USMC, and other BEC members meet six times each year to identify substantive issues, conflicts, or other matters for consideration by this group of managers and agency decision-makers with direct responsibility for, or potential impact upon, lands or resources in the BMGR region. BEC members recognize that the exchange of views, information,

and advice relating to the management of natural and cultural resources will help to identify the best practicable solutions for issues identified.

In accordance with provisions in the MLWA of 1999, the Secretaries of the Navy, Air Force, and Interior established an Intergovernmental Executive Committee (IEC) in December 2001 to provide a forum solely for the purpose of exchanging views, information, and advice relating to the management of the natural and cultural resources within the BMGR. The IEC membership includes those agencies and Native American tribes that may have a direct responsibility for, potential impact upon, or direct interest in the lands or resources of the BMGR. IEC meetings are open to the public and provide non-IEC participants with opportunities to present opinions regarding the BMGR management policies and procedures to the IEC for discussion and possible action recommendations.

Table 2-1. Installation Profile

Office of Primary Responsibility (OPR)	56 RMO for the BMGR East and RMD for the BMGR west have overall responsibility for implementing the natural resources management program and are the lead organizations for monitoring compliance with applicable federal, state and local regulations.
Natural Resources Manager/ Point of Contact (POC)	**BMGR East** 56 RMO/ESMN 7101 Jerstad Lane, Building 500 Luke AFB, AZ 85309 623-856-8487 **BMGR West** Natural Resource Specialist RMD P.O. Box 99134/Building 151 MCAS Yuma, AZ 85369-9134 928-269-6724
State and/or Local Regulatory POCs	**USFWS Ecological Services** Assistant Field Supervisor for Southern Arizona 201 N Bonita, Ste. 141 Tucson, AZ 85745 520-670-6144 **AGFD** Regional Supervisor-Region IV 5000 W. Carefree Highway Phoenix, AZ 85086-5000 602-942-3000
Total Acreage Managed by Installation	BMGR—~1.7 million acres BMGR East—~1 million acres BMGR West —~700,000 acres
Total acreage of wetland	0
Total acreage of forested land	0
Biological Opinions	See Table 2-2 for list of Biological Opinions

Natural Resources Program Applicability	☒ Fish and Wildlife Management ☒ Outdoor Recreation and Access to Natural Resources ☒ Conservation Law Enforcement ☒ Management of Threatened, Endangered, and Host Nation-Protected Species ☒ Water Resource Protection ☐ Wetland Protection ☒ Grounds Maintenance ☐ Forest Management ☒ Wildland Fire Management ☐ Agricultural Outleasing ☒ Integrated Pest Management Program ☒ Bird/Wildlife Aircraft Strike Hazard (BASH) ☐ Coastal Zone and Marine Resources Management ☒ Cultural Resources Protection ☒ Public Outreach ☒ Geographic Information Systems (GIS)

Table 2-2. Active U.S. Fish and Wildlife Service Biological Opinions and informal concurrences for BMGR

DATE; FWS NUMBER	TITLE/DESCRIPTION	LOCATION COVERED
17 Apr 1996; 02-21-95-F-0114 18 Mar 1998; 2-21-95-F-114 16 Nov 2001; 2-21-95-F-114R2 17 Dec 2002; 2-21-95-F-114R3 6 Aug 2003; 02-21-95-F-0114R4 21 Oct 2009; 22410-1995-F-0114-R005 17 Sept 2010; 22410-1995-F-0114-R006 3 Nov 2015; 22410-1995-F-0114-R007	U.S. MCAS-Yuma in the Arizona Portion of the Yuma Training Range Complex (Barry M. Goldwater Range West) Amends BO# 02-21-95-F-0114 to include Stoval airfield. Sonoran pronghorn and lesser long-nosed bat and associated reinitiations 2003 reinitiation addresses Peirson's milkvetch misidentification 2009 reinitiation addresses West Coast Basing of the MV-22 2010 reinitiation addresses West Coast Basing of the F-35B Joint Strike Fighter and associated reinitiations	BMGR West
2 Aug 1997; 02-21-96-F-094 16 Nov 2001; 22410-1996-F-0094-001	Consultation on Military Training at Barry M. Goldwater Range East addressing impacts to the Sonoran pronghorn and lesser long-nosed bat and associated reinitiations	BMGR East

6 Aug 2003; 02-21-96-F-094-R2 4 May 2010; 22410-1996-F-0094-003 14 Mar 2014; 22410-1996-F-0094-004	 2014 reinitiation addresses ending seasonal restrictions on public use during pronghorn fawning season	
19 Sept 1997; 02-21-92-F-0227 16 Nov 2001; 02-21-92-F-0227-R1 & 02-21-93-F-389-R1 6 Aug 2003; 02-21-93-F-389-R2	Western Army National Guard Aviation Training Site Expansion Project addressing impacts to lesser long-nosed bat, cactus ferruginous pygmy-owl, and peregrine falcon. The 2001 and 2003 reinitiations address the Sonoran pronghorn.	Maricopa, Pima, Pinal Counties, AZ including BMGR East
26 Aug 2005; 02-21-05-F-0492 7 Jan 2013; 22410-2005-F-0492-R001 14 Mar 2014; 22410-2005-F-0492-R003 2 May 2018; 22410-2005-F-0492-R005	Biological Opinion for the Integrated Natural Resources Management Plan for the Barry M. Goldwater Range, Arizona and associated reinitiations; addresses impacts to the Sonoran pronghorn, lesser long-nosed bat, and acuña cactus Conference report and compatibility determination to support the 2013 INRMP revision Addresses ending seasonal restrictions on public use during pronghorn fawning season Compatibility determination to support the 2018 INRMP revision	BMGR East & West
3 May 2017; 02EAAZ00-2017-F-0039 30 Sept 2019; 02EAAZ00-2017-F-0039-R001	Formal Section 7 Consultation on the U.S. Army Yuma Proving Ground's Extended Range Cannon Artillery Test Program, Yuma and Maricopa Counties, Arizona and associated reinitiation; addresses impacts to the Sonoran pronghorn and lesser long-nosed bat. 2019 reinitation addresses the acuña cactus and pronghorn	BMGR East & West
12 Dec 1994; 02-21-92-F-066 19 Mar 2014; 02-21-1992-F-066	1994 Biological Opinion on the widening and realignment of Military Training Routes in AZ (addresses Bald Eagle, Peregrine Falcon, Mexican Spotted Owl) 2014 Letter from USFWS concurring with Air Force proposal to avoid Bald Eagle breeding areas by 2,000 feet from 1 Dec to 30 June	Military Training Routes in AZ
26 Apr 2012; 22410-2010-I-0353	USFWS concurrence regarding basing of F35 aircraft at Luke AFB. Document addresses multiple species throughout AZ 2013 Letter from USFWS concurs with Air Force proposal to reduce avoidance buffer around Mexican Spotted Owl Protected	BMGR East; Military Training Routes and Military

23 Dec 2013; 02EAAZ00-2010-I-0353	Activity Centers (PACs) underlying Military Training Routes from 1,320 feet to 500 feet	Operating Areas in AZ
27 Feb 2013; 02EAAZ00-2013-I-0085	USFWS concurrence that MCAS Yuma upgrades of Electronic Warfare Sites (EWS) may affect, but is not likely to adversely affect the Sonoran pronghorn	BMGR West
2 Feb 2017; 02EAAZ00-2017-I-0267	USFWS concurrence that MCAS Yuma Sonoran pronghorn Drinker Upgrades may affect, but is not likely to adversely affect Sonoran pronghorn	BMGR West
27 Jan 2020; 02EAAZ00-2020-I-0332	USFWS concurrence that MCAS Yuma Counter-Intrusion Project may affect, but is not likely to adversely affect Sonoran pronghorn	BMGR West
05 Mar 2020; 02EAAZ00-2020-I-0502	USFWS concurrence that MCAS Yuma Mohawk Coring Study may affect, but is not likely to adversely affect Sonoran pronghorn	BMGR West

2.1 Installation Overview

In support of electronic aircraft tracking and C2/safety voice communication for pilot training at the BMGR, multiple instrument sites are situated on mountain peaks and ridges in the area surrounding BMGR East. Many of these sites are situated on existing BLM-managed communication sites. Each site is managed in accordance with the BLM land use plan and a site-specific communication site management plan. The Childs Mountain communication site is on land managed by USFWS.

Established sites were assessed for potential environmental impacts in previous NEPA documents: Environmental Assessment to Upgrade and Expansion of the Goldwater Measurement and Debriefing System (1995) and Environmental Assessment to Expand the Goldwater Range Measurement and Debriefing System with Three New Sites (1996).

Continued use of these sites are reviewed as existing permits and leases are renewed. Potential environmental impacts are assessed in accordance with 32 CFR 989, Air Force Environmental Impact Analysis Process (EIAP), and AFI 32-7066, Environmental Baseline Surveys in Real Property Transactions. An Environmental Baseline Survey was completed in January 2020 as part of the review for continued use of the Keystone Peak communication site. A review of the Smith Peak communication site is scheduled to be completed by the end of FY20.

2.1.1 Location and Area

The BMGR is located in southwestern Arizona in portions of Yuma, Maricopa, and Pima counties (Figure 1.1). Portions of the BMGR East are located in each of the three counties; the BMGR West is located entirely in Yuma County. The range is approximately 133 miles across on its longest east-west axis. The north-south axes vary in width: at the western end, the north-south axis is approximately 15 miles wide, is generally 18 to 28 miles wide through much of the length of the range, and then narrows to about 4 miles at its eastern end.

The effective size of the BMGR for supporting military aviation training is nearly 40 percent larger than its surface area, as the restricted airspace that overlies the range is about 2,766,700 acres. Also contributing to the effective size of the BMGR is the adjacent Cabeza Prieta NWR, which the MLWA of 1999 stipulates must be managed to support certain military aviation training needs. The refuge,

which is about 860,000 acres, is entirely within the footprint of the range's restricted airspace. The restricted airspace over the refuge extends from the ground surface to 80,000 feet above ground level (AGL) and is fully incorporated in military aviation training.

Additionally, there are more than 85,000 cubic nautical miles of special use airspace used for military operations beyond the airspace above BMGR, Luke AFB, and MCAS Yuma, including not only the adjacent Federal lands, but also Tohono O' odham lands and other parts of southwestern Arizona, as well as a region northeast of Flagstaff, AZ (see section 2.1 in Volume 2 [Luke AFB INRMP] and Volume 3 [MCAS Yuma Installation Overview] in this document for details).

Table 2-3. Installation/GSU Location and Area Descriptions

INSTALLATION/ GEOGRAPHICALLY SEPARATED UNIT (GSU)	MAIN USE/ MISSION	ACREAGE	ADDRESSED IN INRMP?	DESCRIBE NATURAL RESOURCE IMPLICATIONS
BMGR East	Student and operational aircrews training, particularly advanced training for student aircrews transitioning to frontline combat	~1,000,000 acres	INRMP coverage	Major implications include BASH concerns, spread of invasive species, surface disturbances, and erosion
BMGR West	Student and operational aircrews training, particularly readiness training for aircrews in operational combat	~700,000 acres	INRMP coverage	Major implications include BASH concerns, spread of invasive species, and erosion
Gila Bend AFAF	Support training in forward area airfield operations, observation points, and other facilities.	2,011 acres	Covered as part of BMGR East	Major implications include BASH concerns, spread of invasive species, and erosion

2.1.2 Installation History

The BMGR[1] was initially established on 5 September 1941 to support new Army Air Force[2] flying training programs at Luke Field[3] and Williams Field[4] as the U.S. prepared its armed forces prior to deploying them to fight in World War II. The initial parcel of land set aside for the range included most of what is now the BMGR East. By March 1943, additional parcels had been added to the range to expand the training capacity of the eastern portion of the range and support flight training programs to the west at Yuma Army Air Base. Three key characteristics of the range were critical to its intended mission. The range was in close flying proximity to the air bases that it served, was uninhabited and undeveloped, and was large enough to be divided into several sub-areas that could safely support simultaneous but independent training missions. The proximity of the BMGR to military air bases and its size continue to be two of the most important assets of the range for supporting contemporary military training. Military use has continued to preclude habitation or development, with the exception of infrastructure needed for military use.

The Yuma Army Air Base[5] was developed as a training command site separate from those at Luke and Williams fields. This base, and the addition of the western parcels to the gunnery and bombing range, established a second area of aircrew training operations that were independent from those conducted in the eastern range areas. This basic east-west split of range resources has been continued ever since and is currently represented by the BMGR East and the BMGR West divisions of the range.

President Franklin D. Roosevelt originally designated the BMGR through authority provided to the president at that time to execute federal land withdrawals[6]. The BMGR remained under

[1] BMGR and its subparts have had a number of official and unofficial names including "Ajo-Gila Bend Aerial Gunnery Range, "Williams Bombing and Gunnery Range," "Luke-Williams Bombing and Gunnery Range," "Gila Bend Gunnery Range," "Yuma Aerial Gunnery and Bombing Range," and "Luke Air Force Range." Barry M. Goldwater Air Force Range became the official name of the range with the passage of the MLWA of 1986. This was shortened to BMGR with the passage of the MLWA of 1999. This Act also designated BMGR East and BMGR West as the names of the eastern (Air Force) and western (Marine Corps) components, respectively.

[2] The USAF was established as an independent service on 18 September 1947. The Air Force evolved from the Army Air Service, which became the Army Air Corps in 1926, and then the Army Air Force in June 1941.

[3] Luke Field was renamed Luke AFB in January 1951.

[4] Williams Field was renamed Williams AFB after 1947. Williams AFB was closed in 1993.

[5] Yuma Army Air Base was renamed as Yuma Air Base in 1951 and then designated as Vincent AFB in 1956. In 1959, Vincent AFB became Marine Corps Auxiliary Air Station, Vincent Field, Yuma, and in 1962 it become MCAS Yuma.

[6] "Withdrawing" federal lands is to withhold them by executive or legislative action from settlement, sale, location, or entry under some or all of the general land, mining, and mineral laws in order to limit or prohibit activities normally permitted under those laws. Withdrawn lands were then reserved specified

administrative withdrawal until 1986 when Congress passed the MLWA of 1986 (Public Law 99-606), which renewed the range for military use for another 15 years and provided guidance for its use and management. The MLWA of 1986 was superseded by the MLWA of 1999 (Public Law 106-65 1999), which renewed the range for an additional 25 years (until October 2024).

2.1.2.1 Military Use History

The predominant use of the BMGR throughout its history has been to provide land and airspace for air combat training. During World War II, the training emphasis was on aerial gunnery. The eastern range area was used primarily for advanced aircrew training in fighter aircraft, including air-to-air gunnery, air-to-ground gunnery (i.e., strafing), and air combat flight maneuvers. Training in bombing ground targets was added to the curriculum in the last years of the war. The western range area was also used for training fighter aircrews, but the principal activity was air-to-air gunnery training for bomber aircrews.

War department development during World War II was limited primarily to three auxiliary air bases—at Gila Bend, Ajo, and Dateland—and 14 outlying auxiliary airfields. Student aircrews were sent to the auxiliary air bases for concentrated periods of instruction in gunnery and, for some classes, bombing training. The base at Gila Bend Air Force Auxiliary Field (AFAF) is the only one of the three auxiliary air bases that is inside the modern boundaries of the BMGR and continues to operate as a military installation. The former auxiliary base at Ajo is now Eric Marcus Municipal Airport, which is a public-use facility. The former auxiliary base at Dateland is now a privately owned airport that is restricted to authorized users.

Available evidence indicates that the 14 outlying auxiliary airfields were day-use-only facilities where personnel were not permanently stationed. These airfields likely were used as locations to rotate aircrews and, possibly, to refuel or rearm aircraft between successive gunnery training missions. Eight of the 14 outlying auxiliary airfields remain within the modern boundaries of the BMGR; the other six are in locations that are no longer part of the range. Three of the eight outlying auxiliary fields that remain inside the BMGR continue to be used for military purposes. The USMC continues to use Auxiliary Field 2 (AUX-II), located at the far western end of the BMGR West, as a day-use facility. Within the BMGR East, Stoval Airfield, located southwest of Dateland near the northern boundary of the BMGR, and AUX-6, located west of Gila Bend AFAF, continue to be used for occasional training activities.

The BMGR was seldom used for several years following World War II. The outbreak of the Korean War and the growing concern regarding the Cold War prompted reactivation of the gunnery range, Luke AFB (formerly Luke Field), Gila Bend AFAF at the gunnery range, and Yuma AFB in early 1951. Reactivation of the range required substantial repairs and new construction. New target developments transformed the BMGR East from a predominantly aerial gunnery training facility into a complex that could support all phases of tactical air combat training. Instruction in air-to-air

public (or governmental) purposes. For example, military reservations are withdrawn and reserved for national defense purposes. The Defense Withdrawal Act of 1958 (P.L. 85-337) provides that an Act of Congress is required for land withdrawals for military purposes that are more than 5,000 acres in aggregate.

gunnery continued to be an important range function, but the new era also brought training in air-to-air missile firing and an expanded emphasis on the use of aircraft for air-to-ground attack using guns, missiles, rockets, and bombs. Development of the range to support these new training missions included four ground-controlled subranges; five independently located vehicle convoy subranges; a camouflage subrange; a realistic tactical subrange; an air-to-air firing subrange; and a napalm (or fire-bomb) subrange.

USAF use of the BMGR East area during the middle of the Cold War and the Vietnam War era (1960–1974), continued to focus on the training of aircrews to fly fighter and attack aircraft. The tactical, ground-controlled, air-to-air gunnery, and air-to-air maneuvering subranges that had been established during the 1950s were used to provide the necessary training support. However, the subranges were modified throughout this period to meet evolving training needs. By 1960, North, South, and East tactical (TAC) ranges were well established in terms of the ground surface areas dedicated as ordnance impact locations. By 1974, the partitioning of the BMGR East into the four manned ranges, three tactical ranges, and the air-to-air were completed. They are still in use today.

BMGR East was redeveloped and upgraded in the second half of the 1970s to support training that would more realistically resemble potential threat areas. East TAC Range was redeveloped to simulate a European theater, North TAC Range to simulate a Korean theater, and South TAC Range to simulate a Middle Eastern theater. An electronic warfare range was installed to realistically simulate the types of air defense threats that aircrews could encounter in actual combat. The USAF also installed an electronic tracking and telemetry range (now referred to as the Air Combat Tactics System range). These upgrades and additions generally supported aircrew training needs at the BMGR East through the end of the Cold War and the first Persian Gulf War in 1991.

The primary use of the western range area from 1950 to 1958 was to support an air-to-air gunnery and air-to-air rocket firing proficiency program of the USAF Air Defense Command (ADC). This program was based at the Yuma AFB. ADC was responsible for training and deploying the fighter interceptor squadrons that defended the U.S. against airborne attack. The range became the single location to which all ADC units deployed annually for proficiency training. The focus of the proficiency program from 1951 to 1954 was on air-to-air gunnery. No new development of the BMGR West surface area is known to have been necessary to support the ADC proficiency training mission.

The USMC became a regular user of the BMGR in 1959 when Vincent AFB was transferred to the USMC and became Marine Corps Auxiliary Air Station Yuma (MCAS Yuma from 1962 forward). In contrast to USAF use of the BMGR, which had emphasized and continues to emphasize student aircrew instruction, USMC training focused and continues to focus primarily on operational aircrews and units. USMC training stressed air-to-air tactics, gunnery, and missile firing, as well as air-to-ground weapons use. Two target complexes were constructed within the far-western part of the range to support air-to-ground weapons training. A rifle range and a built-up training and administrative site, later called the Cannon Air Defense Complex, were also constructed in this area. These latter two facilities are still in use.

Through the mid-1970s, the area of the BMGR West east of the Gila and Tinajas Altas Mountains was regularly used as a fallout area for aerial gunnery and missile training. Today, this use only occurs during special and infrequent training events. Also during that time, electronic tracking and

telemetry instruments were installed in the eastern portions of the BMGR West to form the electronic architecture of a Southwest Tactical Training Range, which remains in use and is composed of ground-based electronic instrument sites used to track, record, and replay the actions of up to 36 aircraft simultaneously as they participate in air-to-air or air-to-ground combat training.

The primary training emphasis within the BMGR West during the late Cold War and first Persian Gulf War era continued to be readiness training for combat-qualified aviation units. Ground units with a role to play in the integration of USMC air-ground combat teams were also incorporated in some exercises to enhance the realism of the training.

Since the early 1990s, there has been a decline in the need for live air-to-air gunnery and missile firing exercises, but neither the USAF nor the USMC has reduced its requirements for live air-to-ground weapons training. Both the USAF and USMC have added electronic instrumentation that simulates air defense systems and refines their targets to keep pace with evolving air combat tactics and threats.

2.1.2.2 Land Management History

The land management history of the BMGR differs from that of most federal public lands controlled by a single federal agency (such as the BLM, USFWS, National Park Service [NPS]) where resource management is the primary mission. Typical federal agency models are based on a clear purpose and patterns of management are established by the agency's mission, regulations, past management plans and practices, past and current land uses, resource conditions, and public involvement. Management of the BMGR has differed from this model in several important ways. First, there were no clear DoD or DOI resource management priorities specific for the range until the 1980s. Moreover, there was no clear authority for resources management, at either federal or state levels. As a result, there was no development of mutually held goals or coordination of purpose. Second, a comprehensive natural resources management plan was prepared in 1986 and fully implemented in 1990; subsequently, INRMPs were completed in 2007, 2012, and 2018. Finally, at many points in the range's history, management agencies have found themselves with competing or conflicting responsibilities, legal guidance, goals, and purposes without an effective means of resolving these issues.

Primary federal management responsibilities for BMGR lands since 1940 were (or are) as follows.

1. Prior to September 1941: General Land Office and U.S. Grazing Service (these two agencies were merged in 1946 to form the BLM.
2. September 1941 to December 1958: USAF, full responsibility for the entire range.
3. January 1959 to November 1986: USAF military operations management of the BMGR East; USN/USMC military operations management of the BMGR West.
4. November 1986 (MLWA of 1986) to November 6, 2001: No change of military operations of the BMGR. BLM had land management responsibility for the entire range.
5. November 6, 2001 (MLWA of 1999) to November 6, 2024: No change in military operations of the BMGR. The Secretary of the Air Force and Navy have land management responsibility for the entire range.

Considerable progress has been made in recent years towards resolving resource management issues. The MLWA of 1999 clearly established that the USAF and USMC would be responsible for managing the natural resources of the range in accordance with the Sikes Act; thus, the 2007 INRMP became the first plan to be implemented without conflicting federal management guidance. The 2012 update represented the continuation of the implementation of the Sikes Act provisions and provided direction for proper management and protection of cultural and natural resources on the withdrawn lands. The 2018 update of the INRMP provided herein maintains this direction and includes planned projects specific to the FY 2019-2023 timeframe in the five-year INRMP cycle.

2.1.3 Military Missions

The primary mission of the BMGR remains unchanged and has become more critical with the beddown of F-35s at both installations. Student and operational aircrews training occurs throughout the range. However, the preeminent activity at BMGR East is advanced training for student aircrews transitioning to frontline combat aircraft and, at the BMGR West, readiness training for aircrews in operational combat is predominant. In addition, the BMGR serves the USN, Air Force Reserve Command, ANG, and ARNG in these capacities. Other installations that regularly practice at BMGR include MCAS Miramar, Davis-Monthan AFB, Silverbell Army Heliport, and Arizona ANG Base at Tucson International Airport. In addition to regular users, "casual user" training deployments that originate from active duty, reserve, and ANG flying units from other areas of the U.S. and allied units from overseas also train at the range.

2.1.4 Natural Resources Needed to Support the Military Mission

Natural resources required to support the military mission include vast air space and land area for air-to-air and air-to-ground weapons testing and training. Four key attributes of the natural setting and environment of the BMGR are essential to its overall suitability and capacity for supporting tactical aviation and air defense training, aviation tactics development and testing, and other assigned national defense missions. These attributes include:

- a location away from most major population areas yet within the effective training flight radius of aircraft at USAF, USMC, ANG, and ARNG installations in Arizona and California;
- the uninhabited and undeveloped expanse of land and overlying airspace necessary to provide either (1) aviation subranges (up to 13) to support multiple, independent training activities simultaneously or (2) large-scale, range-wide exercises;
- year-round flying weather that allows most training activities to be performed efficiently as planned without weather delays or postponements; and
- varied, wide-open terrain that allows development of diverse, tactical air-land combat training scenarios with realistic air-to-ground target simulations generally with minimal modifications aside from constructing or installing tactical simulations, electronic instrumentation, and other range infrastructure.

Although the BMGR provides a particular advantage for preparing military personnel to operate in arid, hot, and otherwise austere environments (e.g., southwest Asia, Middle East), the range has long proven to be useful for training war fighters for air-land combat operations in nearly all global

theaters. The key to this capability is the fact that tactical features and emplacements, such as airfields or air defense sites, can be simulated within the expansive BMGR in positions and configurations that realistically replicate diverse air-land warfare environments. In a similar fashion, the BMGR landscape has also readily accommodated the infrastructure requirements of the limited ground-based training and support activities that are conducted at the range.

2.1.5 Surrounding Communities

The perimeter of the BMGR is approximately 350 miles. The adjunct lands are predominantly rural, undeveloped, and dominated by federal and tribal lands. Federal lands under the jurisdictions of the BLM, Bureau of Reclamation, or USFWS are dedicated to long-term conservation purposes or a combination of conservation and multiple public uses. These lands abut with approximately 52 percent of the BMGR perimeter (see Figure 1.1). Additionally, the Tohono O'odham Nation shares 7 percent and private or State Trust lands share approximately 30 percent of the perimeter. The remaining 11 percent of the perimeter abuts the international boundary between the U.S. and Mexico.

Private, State Trust, and BLM lands are predominant along the northern boundary of the BMGR from Gila Bend to Yuma along Interstate Highway 8 and along the western range boundary in the vicinity of Yuma. Much of this land has been converted to agriculture over the past decades. Agricultural crop production is particularly prevalent west of Gila Bend near the towns of Aztec, Tacna, Wellton, and Yuma. It is anticipated that new urban development will grow faster than agriculture and change the mix of land use in the future.

The largest adjacent communities and their population estimates (U.S. Census 2017) are summarized in Table 2-4. The majority of the population near the BMGR resides in Yuma County. In 2007, when the housing market collapsed, Yuma County, like most of the nation, experienced a decline in population growth and construction activity (Yuma County Department of Development Services 2012). Before the recession, growth rates for Yuma County had been both robust and predictable, with an average growth rate of 3.84 percent between 1980 and 2000 (Yuma County 2012). Since 2010, the county population growth rate has exceeded the historical average. According to the U.S. Census, the estimated annual population growth rate was about 5 percent from 2010–2017 (U.S. Census Bureau 2017).

Table 2-4: Community populations surrounding BMGR, 2010–2017.

City	2010 U.S. Census Data	Recent Population Estimates
City of Yuma, Yuma County	93,064	96,502[1]
Wellton, Yuma County	2,882	2,947[2]
Tacna, Yuma County	602	674[2]
Gila Bend, Maricopa County	1,922	2,069[1]
Ajo, Pima County	3,304	3,696[2]

[1] 2017 U.S. Census population estimates (as of 1 July 2017) (U.S. Census Bureau 2017).
[2] 2016 U.S. Population estimates unavailable; estimates retrieved from the 2010–2016 American Community Survey at https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml.

The federal government owns approximately 80 percent of the land in Yuma County (Yuma County 2012). Military and agricultural lands represent the two largest segments of unincorporated Yuma County, with approximately 40 percent used for military purposes. Of the remaining 60 percent, 47 percent is used for agricultural purposes (Yuma County 2012).

The community of Gila Bend lies just north of the BMGR East. It has a population of 2,071 and is the site of a 280-megawatt solar-generating station (Gila Bend 2017). The Gila Bend planning area includes approximately 175,000 acres of vacant, relatively flat terrain. Existing land use in Gila Bend is concentrated in town; scattered land uses include large lot residential, energy generation, agriculture, and sand and gravel extraction. No master planned communities are located within the unincorporated portion of the planning area (Gila Bend 2017).

Ajo, in Pima County, is a small community located just south of the BMGR East. Ajo is a former copper-mining hub that has recently experienced community growth. The community population increases dramatically during the winter months as people arrive from farther north to enjoy the warmer climate of Arizona, and many of these people have become permanent residents.

Tohono O'odham Nation land encompasses approximately 2.8 million acres southeast of the BMGR. The Nation is organized into 11 districts, with Hickiwan District abutting the BMGR's most southeastern border. Hickiwan District's on-reservation population is 817. The off-reservation population is 1,259 (Tohono O'odham Nation 2016). The land use includes ranching, livestock grazing, and seasonal livestock camps.

In 2010, the 56 FW and Tohono O'odham Nation signed an MOU to create a framework for consultation on DoD activities at the BMGR East. The MOU formalizes the consultation process but recognizes that the consultation process, in connection with the INRMP and ICRMP, is not included in its purview. In April 2015, this MOU was renewed for an additional five-year period.

2.1.6 Local and Regional Natural Areas

The BMGR and adjacent government lands include a wide array of biologically diverse ecological gradients that characterize the interface between the Arizona Upland and Lower Colorado River Valley in the Sonoran Desert. Once considered a barren wasteland, the Sonoran Desert is now recognized as the most biologically diverse of the great North American deserts. In its entirety, the Sonoran Desert encompasses about 100,000 square miles in southwestern Arizona, southeastern California, Baja California, and western Sonora (Arizona-Sonora Desert Museum 2017). It is the most tropical of the three North American warm deserts (Chihuahuan, Mojave, and Sonoran) and hosts the greatest number of plant communities (Arizona-Sonora Desert Museum 2017).

The BMGR, Cabeza Prieta NWR, Organ Pipe Cactus NM, Sonoran Desert NM, and contiguous BLM-administered lands occupy landscapes that are ecologically interdependent to the degree that management working to conserve ecosystem functions and biological diversity in one of these areas benefits adjacent areas. Further, ecosystem linkages within the BMGR East also extend into contiguous, largely natural areas of Tohono O'odham Nation lands.

Lands adjacent to the BMGR that offer the most recreational opportunities include the Sonoran Desert NM, Cabeza Prieta NWR, and El Pinacate and Gran Desierto de Altar Biosphere Reserve,

Mexico. The Sonoran Desert NM is located along the northeast corner of the range near East Tactical Range (ETAC); the portion of the monument adjacent to the range was formerly part of the BMGR, but it was relinquished to the BLM with the passage of the MLWA of 1999. This area is currently managed by the BLM for semi-primitive recreational opportunities and motorized access to some of the land. The Cabeza Prieta NWR and Wilderness is located along portions of the BMGR's southern border (Figure 1.1).

All of the areas in which recreation is most likely to occur are predominantly undeveloped desert. Most non-agricultural areas are also undeveloped desert, including the land in Mexico south of the BMGR boundary and much of the land north of the BMGR along I-8, particularly between the communities of Gila Bend and Mohawk.

2.2 Physical Environment

2.2.1 Climate

The Southwest region of the U.S. is characterized by a hot and arid variable climate that is strongly influenced by its geographic location and positioning between two circulation regimes. Most of the annual precipitation typically occurs during mid-winter storms or late summer monsoons. Based on long-term weather patterns, average annual rainfall in the higher elevations along the easternmost portion of the BMGR may approach 9 inches and, in the western extremes of the range near Yuma, average annual rainfall is typically no more than 3 inches. Across the entire range, average rainfall is less than 5 inches per year. In the Sonoran Desert, however, rainfall patterns are irregular. As a result, some range locations may receive little or no rain during the same season or year in which other areas receive average or above-average precipitation.

The Sonoran Desert is also subject to frequent and sometimes prolonged drought. As a result, some of the BMGR's interior valleys receive an average of only 0.5 inches of rainfall annually. Overall effects of the minimal rainfall are exacerbated by high temperatures and regional evaporation transpiration potentials that greatly exceed all known rainfall regimes. Summer daytime temperatures often are in excess of 110 degrees Fahrenheit and annual evaporation potentials, which vary from more than 86 inches in the western part of the range to about 72 inches in the eastern, greatly exceed the available precipitation. When the stable weather patterns that promote aridity in the BMGR region periodically break down, all or portions of the range may receive two to three times the normal annual rainfall, sometimes in only one or a few storms.

The Southwest has become warmer and drier over the past century, and projections indicate this trend will continue into the twenty-first century (Overpeck et al. 2013). Droughts will become more severe and precipitation extremes in winter are expected to become more frequent and more intense (Overpeck et al. 2013). Significant changes in climate in this region will have broad impacts on ecosystems and consequences for biodiversity (Bagne and Finch 2012).

DoDI 4715.03, *Natural Resources Conservation Program* (DoD 2017b) states that INRMPs should include an assessment of natural resource management that include the effects of climate change. AFMAN 32-7003, *Environmental Conservation* (USAF 2020) states:

Climate variability and extreme climate events may significantly affect native ecosystems and require the Air Force to adjust natural resources management strategies to support military mission requirements and address the needs of sensitive species. The installation INRMP must consider historical regional trends in climate, and projections of future climate change vulnerabilities and risk to natural infrastructure and sensitive species using authoritative region-specific climate science. The INRMP should list, or include by reference, installation-specific historical climate data and region-specific climate projections. INRMP goals and objectives for ecosystem management and biodiversity conservation must employ an adaptive ecosystem-based management approach that will enhance the resiliency of the ecosystem to adapt to changes in climate.

In 2019, DoD released *A Guide to Incorporating Climate Considerations into INRMPs* (Stein et. al 2019). This guide was developed to help installation managers prepare for and reduce climate-related vulnerabilities and risks and offers a structured process for incorporating climate considerations into INRMPs.

2.2.1.1 Regional Climate Monitoring Program

In the fall of 2011, the BMGR East began a climate monitoring program and installed a network of 12 communication-grade weather stations (Campbell Scientific), manual-download data loggers, and manual-read precipitation storage gauges. In addition to real-time stations, the BMGR East has maintained existing rain gauges and manual-download data loggers to increase the number of climate-monitoring points and provide a more spatially explicit understanding of climate variables. These stations transmit data in real time and collect measurements on the following climatic variables (Black 2015):

- Temperature
- Relative humidity
- Precipitation
- Wind speed
- Wind direction
- Solar radiation
- Soil moisture

Real-time weather can be accessed by visiting http://98.191.112.244/index.html. The website provides real-time visibility to the Luke AFB Weather Squadron, 25th Operational Weather Squadron, Maricopa County Flood Control Department, National Oceanic and Atmospheric Administration, and regional law enforcement agencies. Access to real-time weather data informs time-sensitive resource management issues including (Black 2015)

- locations and servicing of emergency feed and water stations for endangered species;
- timing and control measures for invasive plants; and
- identifying areas where cultural resources may have been subject to extreme erosion events.

The BMGR West has five manual-download weather stations and is exploring options to install communication sensors on the weather stations to also report climate data in real-time. In addition, several agencies have partnered with the BMGR to gain insight into the spatial and temporal distribution of precipitation on a regional scale. The study area encompasses a large portion of southwest Arizona (Figure 2.1). The following partnering agencies participate in this regional monitoring effort (Black 2015).

- BMGR East (USAF)
- BMGR West (USMC)
- Cabeza Prieta NWR (USFWS)
- Kofa NWR (USFWS)
- Organ Pipe Cactus NM (NPS)
- Sonoran Desert NM / Ajo Block (BLM)
- Yuma Proving Ground (U.S. Army)
- Flood Control District of Maricopa County

Natural resources and meteorological staff from partnering agencies aggregate monthly precipitation data using water year (Oct. 1 to Sept. 30) rather than calendar year (Jan. 1 to Dec. 31), to avoid splitting up the winter rain. Monthly precipitation values are combined with data from neighboring agencies, including the National Oceanic and Atmospheric Administration's Cooperative Observer Program stations throughout the region, the El Pinacate and Gran Desierto de Altar Biosphere Reserve in Mexico, and the University of Arizona (UA) Meteorological Network; data from two rain gages at private homes in Ajo and Why are included as well (Black 2015). Aggregated datasets contain monthly precipitation totals for 160 stations across the region. Interpolation is used to estimate precipitation at locations without gages, based on measurements from weather stations, but this can potentially exaggerate the spatial extent of precipitation events due to the highly variable nature of precipitation in the region, especially during the monsoon season. The current method also does not consider elevation, which can be influential in precipitation events.

Future plans to improve regional climate datasets include adjusting the interpolation methodology to factor in elevation and further automating the data aggregation and interpolation processes to improve accuracy. Adding new stations, especially at mountain locations, would allow for more robust datasets, better capture the spatial variability of precipitation, and improve the understanding of how elevation influences precipitation. Additionally, expanding the network to include regional data collected by researchers from the U.S. Geological Survey, NPS, and UA would provide more surfaces for comparison and improve interpolation results (Black 2015).

2.2.1.2 Climate Projections for BMGR East and West

To get a specific estimate of how the environmental conditions at the installation might shift due to climate change, CSU CEMML generated site-specific climate projections for BMGR East and West under two future carbon emission scenarios: Representative Concentration Pathway (RCP) 4.5 (moderate emission scenario) and RCP 8.5 (high emission scenario). The group of researchers then

used these projections to assess potential impacts of future climate on natural resources at the installation.

Historical daily climate data recorded from 1980 through 2009 were used to represent average historical (also called baseline) conditions and generate the climate projections. These data represent the 30-year historical reference point used by the Intergovernmental Panel on Climate Change (IPCC) to define climate change scenarios. Future climate conditions for the BMGR East and West, assessed under both RCP 4.5 and RCP 8.5, were projected to produce two decadal time series of daily climate values for 2026–2035 and 2046–2055, represented hereafter as 2030 and 2050 respectively (CEMML 2019).

The climate assessment was based primarily on publicly available data and data provided by AFCEC. Climate projections were based on recent global climate model simulations developed for the IPCC Fifth Assessment Report (IPCC AR5), the IPCC Coupled Model Intercomparison Project Phase 5 (IPCC-CMIPP5), and the U.S. National Center for Atmospheric Research Community Climate System Model (NCAR CCSM; Hibbard et al. 2007, Moss et al. 2008, 2010, Gent and Danabasoglu 2011, Hurrell et al. 2013).

Climate Model Results

Climate projections for the BMGR East and West are presented in Table 2-5 and Table 2-6, respectively. The main conclusion from this work is that minimum and maximum temperatures will increase over time (for both the 2030 and 2050 time periods) under both emission scenarios (RCP 4.5 and 8.5). The study also predicts changes in precipitation patterns at both locations due to climate change.

BMGR East

For the decade centered around 2030, both emission scenarios project a similar increase in annual average temperature (TAVE) of between 2.1 °F (1.2 °C) and 2.5 °F (1.4 °C) over the historic average (Table 2-5). The two emission scenarios predict higher warming by 2050, with RCP 4.5 expressing a warming of 3.2 °F (1.8 °C) and RCP 8.5 expressing a slightly greater warming of 4.6 °F (2.6 °C).

Annual average precipitation (PRECIP) varies between emission scenarios and over time due to the larger interconnected ocean-atmosphere dynamics associated with the NCAR CCSM model. For 2030, the RCP 4.5 scenario is associated with a large increase in PRECIP of 50% while RCP 8.5 is associated with an increase of 35%. For 2050, RCP 4.5 projects a moderate increase in PRECIP (11%) while RCP 8.5 shows a greater increase of 24% (Climate Appendix: CEMML 2019). Although annual precipitation is projected to increase overall, monthly projections indicate that most of the April, May and June precipitation will remain unchanged. Historically, these months receive the lowest precipitation. The combination of the projected increases in temperature and unchanged precipitation in these months could worsen/extend drought conditions. Precipitation will likely increase during most other months, though the results vary by scenario (Climate Appendix: CEMML 2019).

Table 2-5: Summary of climate data, BMGR East.

VARIABLE	HISTORICAL	RCP 4.5		RCP 8.5	
		2030	2050	2030	2050
PRECIP (inches)	6.2	9.3	6.9	8.4	7.7
TMIN (°F)	57.5	60.0	60.4	60.2	62.0
TMAX (°F)	87.3	89.0	90.9	89.6	92.0
TAVE (°F)	72.4	74.5	75.6	74.9	77.0
GDD	7720	8194	8418	8270	8711
HOTDAYS	131.8	137.9	149.9	143.6	154.5
WETDAYS	0.0	0.0	0.0	0.0	0.0

Notes: TAVE ºF = annual average temperature; TMAX ºF = annual average maximum temperature; TMIN °F = annual average minimum temperatures; PRECIP (inches) = annual average precipitation; GDD = average annual accumulated growing degree days with a base temperature of 50 ºF; HOTDAYS (average # of days per year) = average number of hot days exceeding 90 °F; WETDAYS (average # of days per year) = annual number of days with precipitation exceeding 2 inches in a day.

BMGR West

For the decade centered around 2030, both scenarios project a similar increase in annual average temperature (TAVE) of between 2.1 °F (1.2 °C) and 2.3 °F (1.3 °C) above the historic average (Table 2-6). For 2050, RCP 4.5 is associated with a warming of 3.2 °F (1.8 °C), while RCP 8.5 is associated with a slightly greater warming of 4.6 °F (2.6 °C) for this period.

For 2030, the RCP 4.5 scenario projects a large increase in PRECIP of 61% while RCP 8.5 projects an increase of 58%. For 2050, both scenarios project a moderate increase in PRECIP of 24% (Climate Appendix: CEMML 2019). Although annual precipitation is projected to increase overall, monthly projections indicate that most of the April, May and June precipitation will remain the same. Historically, these months receive the lowest precipitation. The combination of the projected increases in temperature and unchanged precipitation in these months could worsen/extend drought conditions. Precipitation will likely increase during most other months, though the results vary by scenario (Climate Appendix: CEMML 2019).

Table 2-6: Summary of climate data, BMGR West.

VARIABLE	HISTORICAL	RCP 4.5		RCP 8.5	
		2030	2050	2030	2050
PRECIP (inches)	3.8	6.1	4.7	6.0	4.7
TMIN (°F)	56.2	58.6	58.9	58.6	60.6
TMAX (°F)	87.2	88.9	90.9	89.5	92.0
TAVE (°F)	71.7	73.8	74.9	74.0	76.3
GDD	7533	7984	8220	8038	8527
HOTDAYS	123.4	131.1	142.6	136.2	147.0
WETDAYS	0.1	0.0	0.0	0.0	0.0

Notes: TAVE ºF = annual average temperature; TMAX ºF = annual average maximum temperature; TMIN °F = annual average minimum temperatures; PRECIP (inches) = annual average precipitation; GDD = average annual accumulated growing degree days with a base temperature of 50 ºF; HOTDAYS (average # of days per year) = average number of hot days exceeding 90 °F; WETDAYS (average # of days per year) = annual number of days with precipitation exceeding 2 inches in a day.

2.2.2 Landforms

The BMGR is located in the Basin and Range Physiographic Province of Arizona, which is distinguished by broad alluvial valleys separated by steep, discontinuous mountain ranges that run northwest to southeast. There are 15 named mountain ranges representing two physiographic types: sierras and mesas. The Mohawk Range, west of the San Cristobal Valley, is made up of rugged sierras that have characteristic towering jagged profiles. The Aguila Mountains, east of the San Cristobal Valley, are Sierra-type mountains that include one mesa (called Bear Paw). Elevations range from 185 feet above mean sea level (AMSL) at the southwest corner of BMGR West to 4,002 feet above AMSL at the eastern edge of BMGR East atop the Sand Tank Mountains.

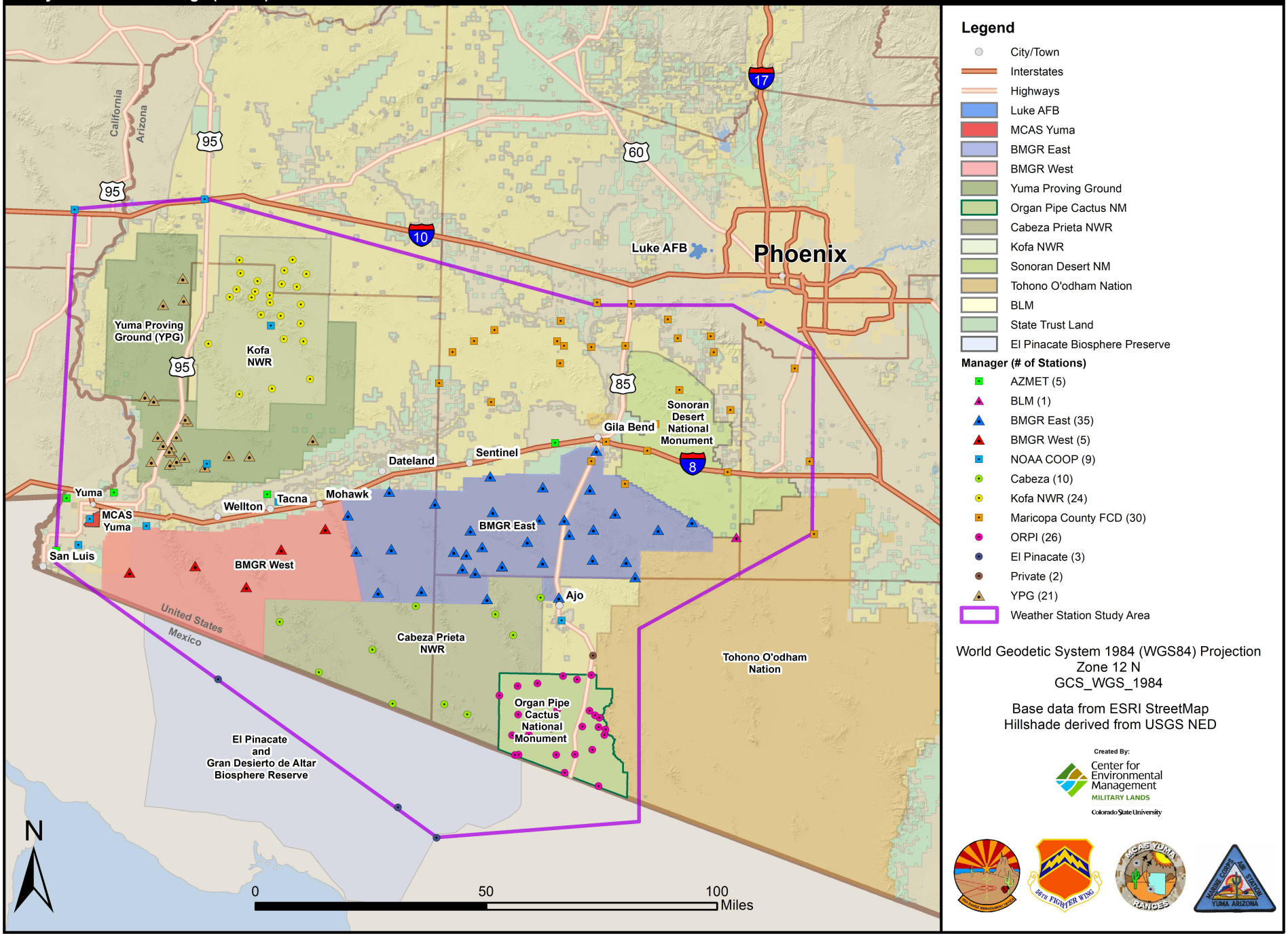
The westernmost valley plains are within the Gran Desierto dune system, which extends both to the west and south and into Mexico. Smaller sand dune systems have also formed in several other range locations, with the most expansive being Mohawk Sand Dunes in the central portion of the range.

Volcanic landforms are found on some parts of the range; the most notable is the Sentinel Plain Volcanic Field. A second volcanic landscape, the Crater Range, consists of eroded basalt-andesite lava flows with cliff-like escarpments and ridge-forming dikes. Isolated pillars mark the location of volcanic conduits.

Figure 2.1: Regional Weather Stations

Barry M. Goldwater Range (BMGR)

2018-2023 Integrated Natural Resource Management Plan (INRMP)



Legend

- City/Town
- Interstates
- Highways
- Luke AFB
- MCAS Yuma
- BMGR East
- BMGR West
- Yuma Proving Ground
- Organ Pipe Cactus NM
- Cabeza Prieta NWR
- Kofa NWR
- Sonoran Desert NM
- Tohono O'odham Nation
- BLM
- State Trust Land
- El Pinacate Biosphere Preserve

Manager (# of Stations)

- AZMET (5)
- BLM (1)
- BMGR East (35)
- BMGR West (5)
- NOAA COOP (9)
- Cabeza (10)
- Kofa NWR (24)
- Maricopa County FCD (30)
- ORPI (26)
- El Pinacate (3)
- Private (2)
- YPG (21)
- Weather Station Study Area

World Geodetic System 1984 (WGS84) Projection
Zone 12 N
GCS_WGS_1984

Base data from ESRI StreetMap
Hillshade derived from USGS NED

Created By:
Center for Environmental Management
MILITARY LANDS
Colorado State University

2.2.3 Geology and Soils

The mountain ranges are formed from igneous, metamorphic, and sedimentary rock types. The alluvial valleys are deep bedrock basins filled with silt, clay, sand, and gravel deposits. These deposits can be more than 10,000 feet deep. Along many of the mountain bases, sloping masses of alluvial fill material, known as *bajadas*, extend outward like fans to taper more gradually than the mountains themselves into the generally flat valley floors.

In some parts of the range, there are extensive sheet-like formations of lava from past flows. These flows form irregular plains with rough basalt surfaces. Portions of the largest such lava flow in southern Arizona extend into the northern part of the range south of the community of Sentinel. The BMGR region is in a tectonically stable area with few earthquakes and few active faults.

BMGR East

The BMGR East has an aridic soil moisture regime and a hyperthermic soil temperature regime. As a result, the soils are primarily Aridisols with few occurrences of Entisols, and one small area classified as Andisols (Natural Resources Conservation Service [NRCS] 2012). The soils are typically shallow and rocky with thin A horizons and varying texture. They are calcareous in nature, with high drainage capacity and limited available water holding capacity (NRCS 2012, as cited in Whitbeck 2013).

BMGR West

In accordance with the BMGR INRMP Five-Year Action Plan 2013–2017, UA developed and implemented a digital soil mapping technique specifically for characterizing the complex alluvial and eolian deposit-dominated landscape of the BMGR West (Rasmussen and Regmi 2015). This project resulted in a range-wide, digitally assessed, high spatial resolution soil-landscape classification map depicting soil landscape variability and distribution (Rasmussen and Regmi 2015). The BMGR West staff is working with UA to complete a range-wide soil map, incorporating the newly developed soil mapping technique, within the planning period covered by the 2018 INRMP. The soil map will serve as a decision-making tool for assessing the potential for erosion and natural hazards.

2.2.4 Hydrology

Principal rivers in the region include the Gila and Colorado Rivers. The Gila River runs east to west just north of the BMGR boundary and connects to the Colorado River northwest of the range. Surface water on BMGR lands, however, is very limited. There are no perennial or intermittent streams present, and ephemeral stream flow occurs only in immediate response to sizeable rainfall events. Surface water drainage flows outward from the mountain ranges and, for most of the area, ultimately northward by numerous feeder washes into the larger washes that flow to the Gila River, which in turn flows west into the Colorado River.

Natural flooding events are highly variable in frequency and intensity and can have a large effect on natural community composition, structure, and function. Some storms cause flash flooding in the smaller mountain drainages and short-term flooding in the larger valley washes and floodplains. Some rainwater collects in natural rock catchments (also known as *tinajas* or tanks), human-modified

natural catchments, or artificially constructed wildlife waters where the water may persist for weeks or months without recharge until it eventually evaporates or is consumed by wildlife or people.

BMGR East

There are four primary natural sources of water on the BMGR East: tinajas, charcos, playas, and springs (Bryan 1925). Tinajas are natural rock-cut tanks that are generally found on the floor of drainages. They are called sand tanks when filled with sand. Tinajas are the most reliable source of water in the region. Some hold water year-round while others are intermittent or ephemeral, lasting from a few weeks to a few months. Broyles (1996) identified 128 tinajas in the Western Papagueria, which could provide up to 3,000,000 liters (792,516 gallons) of water when full. Named tinajas on BMGR East include White Tanks, Chris Glyphs, and Black Tank in the Crater Mountains and Eagle Tank and Don Diego Tank in the Aguila Mountains. Water can usually be found at Eagle Tank because the tinajas are protected from the sun and wind to some extent, and evaporation rates are low. New tinajas are identified annually and are mapped, recorded, photographed and entered into the BMGR East GIS.

Charcos are natural or artificial water holes found in relatively impermeable soils (Bryan 1925) in adobe flats and along streambeds of washes with relatively flat areas of sandy clay. Charcos, named after the Spanish word for 'pool of standing or stagnant water,' are found as either single pools or as a series of pools.

Playas are shallow lakebeds resulting from internal drainage patterns within closed basins. Many playas are fed only by rainwater while others are fed by groundwater or by surface water in wash channels. Two playas on the BMGR East hold water after substantial rainfall events. The NTAC playa, which is the largest, receives drainage from the Aguila Mountains, the Crater Range, Childs Valley and Growler Valley. This playa held water for several weeks after monsoon storms of 2014. Lago Seco, on Range 4, is fed by rainwater and drainage from a channel of Midway Wash.

Two types of springs are found in the region: fracture springs, which depend on rainwater stored in fractures of certain rock types, and fissure springs, which derive their water from along fault lines (Bryan 1925). Bender Spring, originally called Indian Spring on USGS maps, is a fracture spring located in the Sand Tank Mountains in the far northeastern corner of BMGR East. It is generally a reliable source of water but has been known to dry up during prolonged periods of draught. Burro Spring is an intermittent spring in the Sand Tank Mountains, with its name derived from feral burrows that paw the sand to reach the water there.

The BMGR East lies primarily within three of the seven hydrological basins of the Sonoran Desert: the Lower Gila River, Tenmile Wash, and San Cristobal Wash (Heilen and Vanderpot 2013). The hydrographic subdivisions are dissected by a network of ephemeral washes, generally flowing from southeast to northwest, toward the Gila River. Washes tend to migrate across valley floors where drainage follows a braided pattern. Relict stream channels of Tenmile Wash have been documented 1.24 miles south of its present location.

The largest of the subdivisions is the Tenmile Wash system, which contains more than 459,998 acres within BMGR East. Tenmile Wash originates in the Batamote Mountains south of Area B and also receives flow from Childs Mountain/Little Ajo Mountains. It flows through the southern portion of Area B, the northern portion of Manned Range 1 and NTAC, and the extreme western portion of Range 4, before flowing to the Gila River. The Tenmile Wash subdivision, which drains over 19.3 square miles, also contains Midway Wash, which has wash channels that originate in the Sauceda Mountains on the east side of Area B and from the Batamote Mountains south of Area B. Midway Wash flows through a part of Area B, Range 2 and Range 4. It is not through-flowing, and terminates on Range 4. At least one wash channel of Midway Wash flows into the Lago Seco (Dry Lake) playa on Range 4.

The San Cristobal/Growler subdivision, which contains more than 299,998 acres within BMGR East, contains Growler Valley and San Cristobal Valley. The San Cristobal/Growler Wash system has a very low gradient along much of its sources and has created a broad, interlacing network of many small, branching and reuniting channels. Growler Wash, which is tributary to San Cristobal Wash, originates in the Cipriano Hills in Organ Pipe Cactus National Monument and flows north-northwest through the Growler Valley on the Cabeza Prieta National Wildlife Refuge and southern end of STAC. Daniels Arroyo, which drains Childs Mountain/Little Ajo Mountains and the Growler Mountains located on STAC, is the major tributary of Growler Wash.

The Lower Gila River Subdivision, contains Quilotosa and Sauceda Washes, which originate in the Sand Tank Mountains and Sauceda Mountains respectively, and are through-flowing to the Gila River.

Groundwater is found primarily in tertiary volcanic rocks and alluvial deposits. Recharge occurs via infiltration of rainfall runoff and underflow from adjacent alluvial basins. Groundwater quality is found to be poor and typically includes high concentrations of total dissolved solids and fluoride (56 FW 2010). Historically, depth to groundwater has been fairly shallow, varying from 10 to 60 feet in wells dug in crystalline rock and 19 to 88 feet in wells dug in alluvium (Bryan 1925).

Wells are an additional, non-natural source of water on the BMGR East. Initially, wells were dug primarily for ranching, which began in the late 1880s. In the early 2000s, wells were dug to supply water to forage plots for the Pronghorn. One of the wells was 400 feet deep, with groundwater thought to be at around 243 feet. Wells registered to the USAF are located at Gila Bend AFAF, NTAC, and at Range Munitions Consolidation Point 1 (56 FW 2010). Production wells at Gila Bend AFAF and Range Munitions Consolidation Point 1 currently supply water for construction, dust control, potable water supply for selected facilities, and maintenance activities (56 FW 2010).

Flooding may occur along the major washes due to brief, intense summer monsoon events or longer-duration late fall and winter rainfall events. Significant rainfall events over the past few years have caused considerable erosion on the ETAC, sometimes temporarily making roads impassable. In 2014, a section of the road between SR 85 and Range 1 washed away, affecting daily travel to and from several ranges and damaging a previously recorded archaeological site (CRP, in prep.).

2.2.4.1 Stream Channel Modeling for BMGR East

CSU CEMML conducted stream channel overflow modeling (or flood modeling) for the BMGR East along the San Cristobal/Growler Wash System in the San Cristobal Valley and Tenmile Wash to examine the extent of flooding associated with climate projections. The team also conducted flood modelling for the Gila Bend AFAF but did not conduct modeling for the BMGR West because available data was not sufficient to conduct a reliable analysis.

Flood modeling did not consider flooding of independent surface bodies, stormwater systems, or surface ponding. Models instead used local watershed characteristics and the design storms generated from climate projection data. The projected design storms do not represent extreme weather events (e.g., hurricanes, extraordinary storm fronts). Inundation projections were influenced by four variable inputs: (1) variation in total precipitation between design storms, (2) variation between the daily distribution of precipitation over the three-day period, (3) land cover change over the watershed area used in hydrologic modeling, and (4) land cover change in the area within the installation used in hydraulic modeling.

The projected inundation associated with each climate scenario and the relative change from baseline conditions at BMGR East and Gila Bend AFAF are summarized in Table 2-7 and Table 2-8, respectively. The spatial extent of projected flooding is depicted in a series of maps included in the Hydrology Appendix of the CSU CEMML climate change report (CEMML 2019). Projected changes in stream channel overflow can be used to assess potential vulnerabilities to species, habitats, the mission, and built and natural infrastructure.

Table 2-7: Projected inundation along San Cristobal/Growler Wash and Tenmile Wash, BMGR East.

	BASELINE	RCP 4.5		RCP 8.5	
	2000	2030	2050	2030	2050
Projected inundation (acres)	49920	93624	43020	71670	85172
Change in inundation area from baseline (acres)		43704	-6900	21750	35253
Percent change from baseline (%)		87.5	-13.8	43.6	70.6

Table 2-8: Projected inundation at Gila Bend AFAF, BMGR East.

	BASELINE	RCP 4.5		RCP 8.5	
	2000	2030	2050	2030	2050
Projected inundation (acres)	439.8	31.3	301.3	447.4	397.7
Change in inundation area from baseline (acres)		-408.5	-138.5	7.6	-42.1
Percent change from baseline, (%)		-93	-32	2	-10

BMGR West

BMGR West consists of three major watersheds: Yuma Desert Wash, which drains west into the Colorado River, and Coyote and Mohawk washes, which drain to the north into the Gila River (Duan et al. 2017).

In June 2015, BMGR West began to monitor erosion across the range using three field methods: (1) deployment of a three-dimensional camera, (2) ground-based light detection and ranging (also known as LIDAR), and (3) manually measuring erosion using an electronic, survey-grade theodolite total station (Duan et al. 2017). Monitoring erosion will help the BMGR West resource managers prioritize erosion-prone areas and identify whether wind or rainfall runoff erosion is dominant (Duan et al. 2017). The results will have implications in developing restoration strategies for selected sub-basins across the range (Duan et al. 2017).

2.3 Ecosystems and the Biotic Environment

2.3.1 Ecosystem Classification

Ecoregions delineate areas of general similarity in ecosystem type and the type, quality, and quantity of environmental resources. Ecoregions are identified through the spatial patterns and composition of biotic and abiotic phenomena, including geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. A Roman numeral hierarchical scheme has been adopted for classifying different levels of ecological regions, with Level I being the coarsest and Level IV the most detailed. The BMGR lies within the Level III Sonoran Basin and Range Ecoregion, which encompasses several Level IV ecoregions (Griffith et al. 2014). They are designed to serve as a spatial framework for the research, assessment, management, and monitoring of ecosystem components. Ecoregions are critical for structuring and implementing ecosystem management strategies across various agencies and organizations.

The majority of the BMGR is located within the Dry Domain, Tropical/Subtropical Desert Division, American Semi-Desert and Desert Province (Bailey 2014). Ecosystems in this division are typically arid and have high air and soil temperatures with extreme variation between day and night temperatures (Bailey 2014).

The range has maintained its ecological integrity over the past 80 years, largely because its mission predominantly utilizes the airspace above the range. Furthermore, the restrictions placed on land use exclude grazing and mineral extraction, and they limit both development and public access to some degree (Rosenberg 2015).

2.3.2 Vegetation

Nearly 290 species of Sonoran Desert plants characteristic of the Arizona Upland and of the Lower Colorado River Valley are reported to occur at BMGR. The bajadas of all of the mountain ranges (Growler, Crater Range, Aguila) are all characterized by the Arizona Uplands subdivision of the Sonoran Desert. The most extensive area of Arizona Uplands is east of SR 85 in the Sauceda and Sand Tank Mountains. The Lower Colorado River Valley subdivision occurs in the valleys between the mountain ranges. The distribution of plant communities in both of these areas is influenced by the

diverse landscape of the range, in which the series of widely spaced rugged mountain ranges, broad valley plains, sand dune systems, surface water drainages, and *playas* are the most important features.

2.3.2.1 Historic Vegetative Cover

The beginning of agriculture in the Sonoran Desert occurred around 2000 BCE with the arrival of corn from Mexico. By 1500 BCE, Early Agriculturalists constructed irrigation ditches or short canals along the floodplain of the Santa Cruz River in Tucson. Around 450 CE, people in the Phoenix Basin began to construct massive irrigation systems that included over 300 miles of canals. Other agricultural strategies included "Ak Chin" agriculture, where fields are placed near the mouth of an arroyo and floodwaters from the wash are diverted into the fields. When the Europeans arrived, they introduced Eurasian plants, animals, and microbes that transformed the landscape in "an ecological revolution. . . ." (NPS 2016). Mining and livestock grazing were the two largest land uses, which by the mid-19th century had caused substantial degradation in the central and southern Sonoran Desert, with numerous accounts of overgrazing and subsequent abandonment (NPS 2016). In 1937, a coarse-scale vegetation map was developed for Arizona (Figure 2.2) (Nichol 1937). Nichol classified the mountains as "Palo Verde-Cacti, and Burr Sage" and the valleys as "Creosote Bush + Salt Brush" (Nichol 1937).

2.3.2.2 Current Vegetative Cover

As a part of the 2007 INRMP planning process, The Nature Conservancy reviewed the ecological structure, composition, and processes of the current vegetation cover and identified 13 natural communities. Nine of these 13 natural communities and their estimated sizes, based on the best available geographic information system (GIS) information, are as follows.

- Valley Bottom Floodplain Complex—29,000 acres
- Dune Complex and Dune Endemics—30,000 acres
- Creosote Bush (*Larrea tridentata*) - Bursage (*Ambrosia* spp.) Desert Scrub —1,360,000 acres
- Creosote Bush - Big Galleta (*Hilaria rigida*) Scrub—24,000 acres
- Paloverde (*Parkinsonia* spp.) - Mixed Cacti - Mixed Scrub on *Bajadas* —191,000 acres
- Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes —63,000 acres
- Sand Tank Mountains Uplands—10,000 acres
- Elephant Tree (*Bursera microphylla*) - Limberbush (*Jatropha cinerea*) on Xeric Rocky Slopes—91,000 acres
- Desert *Playa*—170 acres

Areas occupied by the Salt Desert Scrub community and by the Desert *Tinajas*/Springs community are small and were not estimated as part of the 2007 assessment. Two xeroriparian communities are associated with washes. The extent of these communities is best described in linear units:

- Valley Xeroriparian Scrub—2,325 linear miles

- Mountain Xeroriparian Scrub—400 linear miles

These natural communities are described in terms of their ecological characteristics (composition, structure, function/ecological process, physiographic occurrence, and associated soil characteristics) in Table 2-9 and their locations are illustrated in Figure 2.3. The xeroriparian communities align with the washes shown in Figure 2.3. (The isolated point data for Salt Desert scrub communities east of the Copper Mountains and east of the Mohawk Mountains are not illustrated.)

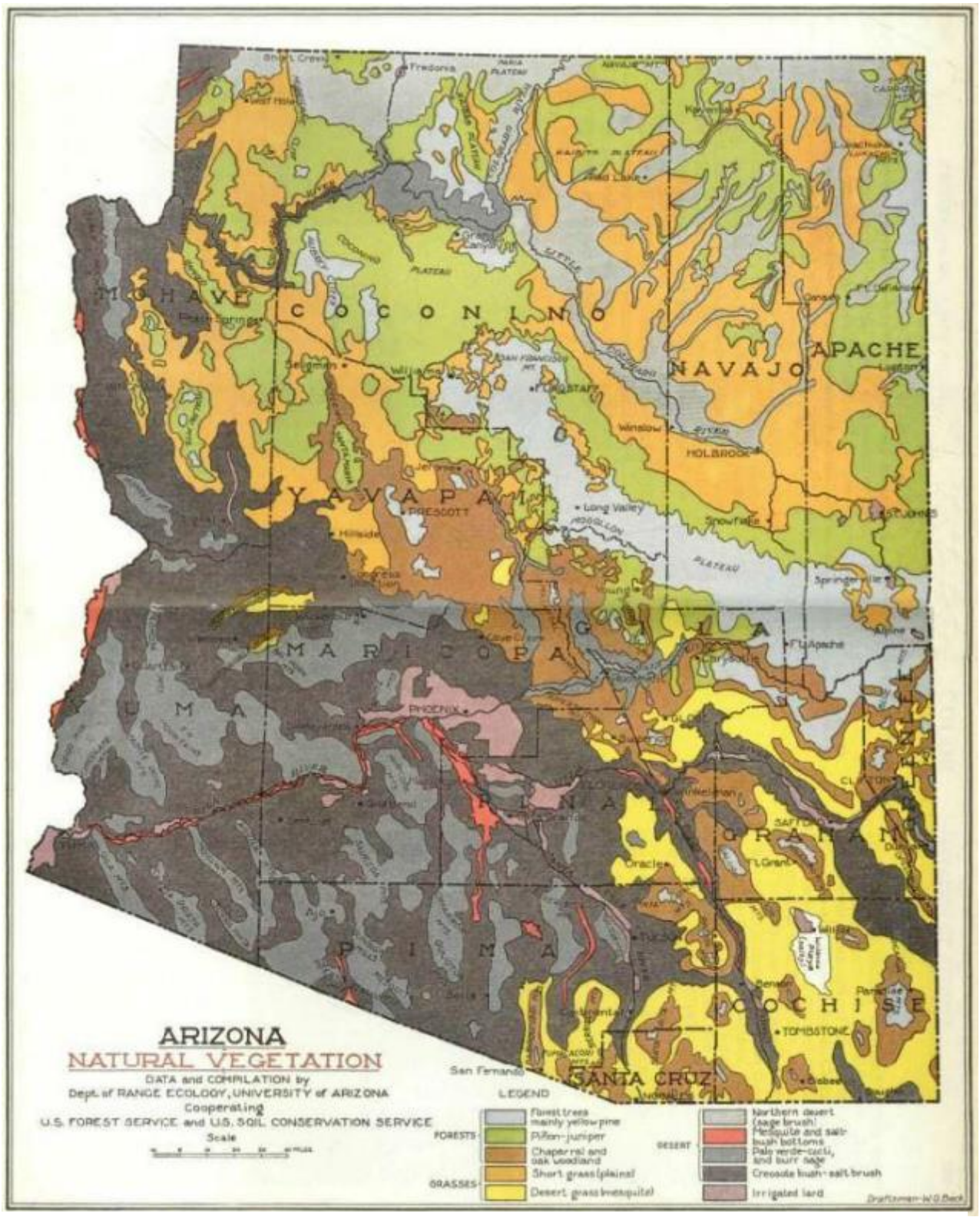


Figure 2.2: Arizona natural vegetation (Nichol 1937).

Table 2-9: Ecological characteristics of the BMGR natural vegetation communities, as assessed by The Nature Conservancy.

Natural Community Element	Composition	Structure	Function/ Ecological Process	Physiographic Occurrence	Associated Soil Characteristics
Valley Bottom Floodplain Complex	Characteristic vegetation includes creosote bush, triangle-leaf bursage (*A. deltoidea*), white bursage (*A. dumosa*), acacias (*Acacia* spp.), paloverdes, mesquites (*Prosopis* spp.), and annual and perennial grasses.	Community occurs as patchy, shifting mosaics of sparse vegetation in relatively dry areas interspersed with dense vegetation within shallow depressions where water accumulates. Linear occurrences of vegetation characteristic of the Valley Xeroriparian Scrub community may be present within this complex.	Forms on nearly flat terrain (valley bottoms) where sheet flow may be an important hydrological phenomenon. Vegetation provides forage, cover, nesting sites, and perches for wildlife.	Vegetation is located at the base of pediments and extends onto valley floors. Examples are found in the Growler and San Cristobal Valleys.	Generally forms on deep loams and sandy loams that are often prone to accelerated erosion.
Dune Complex and Dune Endemics	Complex is generally sparsely vegetated by scattered forbs and grasses. May include shrubs and dwarf shrubs such as white bursage. Stabilized dunes may support creosote bush and mesquites while active dune fields may lack vegetation.	Community occurs as patchy shifting mosaic within Creosote Bush – Bursage Desert Scrub. Includes active open dunes, stabilized dunes, and stabilized flat, sand sheets. This complex has a sparse and seasonally variable herbaceous layer with a sparse cover of shrubs that are less than seven feet tall.	Contains a high number of endemic species that have adapted to moving sand. Water may be held for long periods just under the surface by sand.	Active, stabilized, and partially stabilized dunes found in valleys. Dune complexes are found west of the Mohawk Mountains, in the Gran Desierto southeast of Yuma, in San Cristobal Valley, and in the northern Growler Valley.	Area consists of sand dune complexes.
Creosote Bush – Bursage Desert Scrub	Vegetation is primarily dominated by creosote bush. Woody and non-woody cacti and rosette succulents commonly occur on rocky slopes. Seasonally present perennial grasses with some perennial forbs dominate the sparse herbaceous layer.	Includes extensive networks of Valley Xeroriparian Scrub communities with large patches of active and stabilized dune complexes. Vegetation typically includes sparse to moderately dense layers of microphyllous and broad-leaved evergreen subshrubs and shrubs less than 7 feet tall.	Linear xeroriparian systems and large patch dune fields nested within the creosote bush-bursage-matrix dominate.	This community is found on lower *bajadas* and intermountain basins that are generally flat or on gentle to moderate slopes. Vegetation on the lower bajada*s* and valley west of the Sauceda Mountains is a good example of this community.	Substrate is usually sandy or gravelly alluvium derived from limestone and metamorphic rocks. Soils are typically of low salinity.
Creosote Bush – Big Galleta Scrub	Dominant shrub is Creosote bush. Big galleta is the sole or dominant grass in the herbaceous layer. White or triangle-leaf bursage can be a co-dominant.	Scattered shrubs and dense grasses typically form the first two layers of vertical structure of this complex. A tree canopy provides a third layer when mesquite is present.	Located on highly erodable sands around downcutting desert washes. Also sometimes found on hillsides where sand has accumulated downwind and vegetation has been dispersed by birds.	This community may be found growing on flat ridges, low gradient slopes and among stabilized sand dunes in portions of the Mojave and Sonoran deserts. The only mapped occurrence of the community is located in the Sentinel Plain area.	Soils generally consist of sandy loam. These soils are well-drained.
Paloverde – Mixed Cacti – Mixed Scrub on *Bajadas*	Vegetation has a conspicuous but relatively sparse layer of saguaro cactus (*Carnegiea gigantea*). A sparse to moderately dense short tree / tall shrub canopy is also present and consists of paloverde and creosote bush and, less prominently, ironwood and ocotillo (*Fouquieria splendens*). A sparse herbaceous layer dominated by perennial grasses and forbs with some annuals is present.	The dominant vegetation occurs in sparse to moderately dense woody layers of short shrubs, tall shrubs, and short trees, ranging from 1.5 to 16 feet tall. The herbaceous layer is generally sparse with scattered perennial grasses and forbs. The uppermost layer consists of a layer of large, columnar cacti.	Linear xeroriparian systems are nested within the matrix of this community. Climate extremes may cause die-back of many plant species.	This community typically surrounds rocky slopes of low mountain ranges. The best example of this community occurs on the lower slopes and *bajadas* of the Sand Tank Mountains.	Soil generally consists of gravelly alluvium derived from basalt. Soil substrates are generally coarse-textured, shallow, gravelly clay loams. Caliche is a common characteristic.

Table 2-9: Ecological characteristics of the BMGR natural vegetation communities, as assessed by The Nature Conservancy.

Natural Community Element	Composition	Structure	Function/ Ecological Process	Physiographic Occurrence	Associated Soil Characteristics
Paloverde – Mixed Cacti – Mixed Scrub on Rocky Slopes	This community is of similar composition to that of the Paloverde – Mixed Cacti – Mixed Scrub on *Bajadas* but contains additional associates such as teddy bear cholla (*Cylindropuntia bigelovii*).	This community is found along narrow drainages throughout large patches of sparse to clumped vegetative canopies. It generally occurs on highly irregular bedrock outcrops.	Linear xeroriparian systems are nested within the matrix of this community. Climate extremes may cause die-back of many plant species.	This community is found throughout low mountain ranges, primarily above the major pediments. The best example occurs in the Sauceda Mountains.	This community occurs on highly irregular bedrock outcrops. Soils are generally of the Lithic Camborthids-Rock Outcrop-Lithic Haplargids Association, which are typically composed of very cobbly to cobbly loams, very stony to stony loams, gravelly very fine sandy loams, and rock outcrops. Soils of these mountains are subject to slight water erosion.
Sand Tank Mountains Uplands	Vegetation in this complex includes saguaro cactus and a sparse to moderately dense canopy of short trees / tall shrubs consisting of paloverde and creosote bush. Typical associates include crucifixion thorn (*Koeberlinia spinosa*) and Sonora rosewood (*Vauquelinia californica sonorensis*). Also present is a sparse herbaceous layer dominated by perennial grasses and forbs.	Large patches of a sparse to clumped vegetative canopy are found on steep, highly irregular bedrock outcrops. The structure is variable and influenced by aspect, edaphic characteristics, and sheltering cliffs and rocks.	Dynamic processes on landscapes dominated by this community are driven by linear xeroriparian systems that are nested within the larger community. Climate extremes may result in the periodic die-back of many plant species.	This community occurs at high elevations in and around the Sand Tank Mountains.	The community occurs on steep, rocky slopes. Soils of these mountains are subject to slight water erosion. They are comprised principally of the Lithic Camborthids-Rock Outcrop-Lithic Haplargids Association, which are generally very cobbly to cobbly loams, very stony to stony loams, gravelly very fine sandy loams, and rock outcrops.
Elephant Tree – Limberbush on Xeric Rocky Slopes	The composition of this community is similar to that of the Paloverde – Mixed Cacti – Mixed Scrub system, but is characterized by additional associates. Elephant tree, limberbush, Bigelow's nolina (*Nolina bigelovii*), and Kearney's sumac (*Rhus kearenyi*) are dominant in a mixed canopy. Vegetation of this system may differ with substrate.	This community forms large patches with a sparse to clumped vegetative canopy on highly irregular bedrock outcrops.	Linear xeroriparian systems are nested within the matrix of this community. Climate extremes may result in the periodic die-back of many plant species.	This community is found throughout low mountain ranges in the most arid portions of the Lower Colorado Valley and Arizona uplands of the Sonoran Desert. Mountain Xeroriparian Scrub is found throughout this large-patch community along narrow drainages. Examples of this community occur in the Tinajas Altas and Gila Mountains.	The community is commonly associated with granite bedrock and granite-derived gravels at the base of the mountains.
Desert *Playa*	Generally, desert *playas* in the central Sonoran Desert are sparsely vegetated, with periodic emergence of ephemeral species. Large *playas* in the Sonoran Desert may have surrounding rings of vegetation. Characteristic vegetation differs between *playas* and unpredictable annuals may emerge.	Large patches are formed on flat plains and basins. Deep ravines may be formed as a result of drainage into the *playas* but are subsequently filled in. Desert *playas* are often located within a matrix of Creosote Bush/Bursage Desert Scrub and may be associated with active and stabilized sand dunes.	Dominant ecological processes of desert *playas* are periodic flooding and subsequent evaporation. Large mud cracks at *Las Playas* may be related to volcanic activity.	Large open expanses that support *playa* lakes may also serve as sand sources for dunes located down-wind. Rainfall absorbed into dune fields may serve as a water source for seepage into the *playa* lakes. Many *playas* include dissected streambeds that are erased through time. Mohawk Playa is the best example at BMGR.	*Playas* are typically associated with active and stabilized sand dunes.
Desert *Tinaja* / Spring	*Tinajas* are typically small aquatic ecosystems formed through water accumulation in bedrock depressions. Vegetation is typically absent or present as a few individual plants.	The community generally appears in the form of small patches among bedrock exposures.	The periodic inflow and slow evaporation are the primary processes that support *tinajas. Tinajas* may retain water permanently.	This community may occur in bedrock depressions throughout the Desert Southwest. Examples include *Tinajas* Altas and Bender Springs.	The community is commonly associated with bedrock depressions.

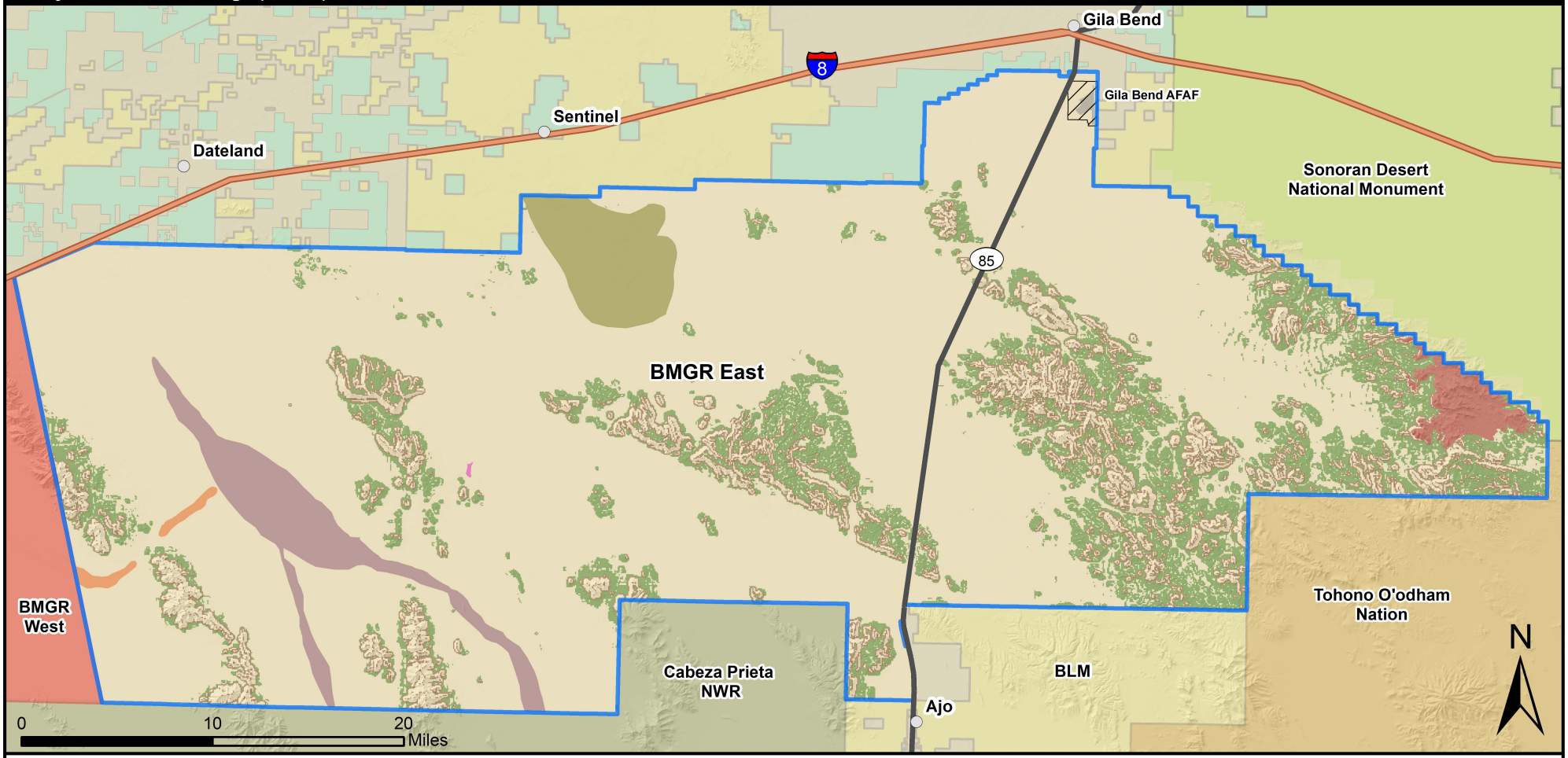
Table 2-9: Ecological characteristics of the BMGR natural vegetation communities, as assessed by The Nature Conservancy.

Natural Community Element	Composition	Structure	Function/ Ecological Process	Physiographic Occurrence	Associated Soil Characteristics
Salt Desert Scrub	Two main types of saltbush communities occur. Saltbush communities found along major riverine systems typically have been converted to agriculture. The drier upland type is associated with creosote bush and numerous cactus species. The community is dominated by the xeromorphic shrub, cattle saltbush (*Atriplex polycarpa*). The sparse to moderately dense graminoid layer may be dominated by warm-season, medium-tall and short grasses. Forb cover is generally sparse.	This community may form large patches on desert *bajadas*. Vegetation typically has a sparse to moderately dense layer of shrubs up to 7 feet in height.	The dominant xeromorphic shrub, *Atriplex polycarpa,* tolerates saline or alkaline soils and marks the extent of deep, fine loams of significant agricultural value. Periodic flooding, while infrequent, is tolerated by this community.	This community occurs on both upland and lowland sites throughout much of the arid and semi-arid western U.S. Lowland sites include alluvial flats, drainage terraces, *playa*s, washes, and interdunal basins, whereas upland sites include bluffs and gentle to moderately steep sandy or rocky slopes. An example of this community occurs within the San Cristobal Valley.	Soils are variable, with depths ranging from shallow to moderately deep and textures ranging from sands to loams to clay. Lowland sites may be moderately saline or alkaline.
Valley Xeroriparian Scrub	Characteristic vegetation is highly variable and includes blue and foothill paloverdes (*P. florida* and *P. microphylla*, respectively), ironwood (*Olneya tesota*), mesquite, herbaceous and woody perennial vines, and sparse annual grasses and forbs.	Found in narrow linear strips in downcut channels with a moderate to dense layer of trees and shrubs that are generally less than 16 feet tall. Herbaceous layer typically is sparse.	Channel-constricted flow is the dominant ecological process. Frequency and amount of runoff, shading, and channel scouring influence xeroriparian vegetation gradients.	Found on mountain slopes with a grade of less than 6 percent and extend onto valley bottoms. This community is predominant in the more arid areas west of SR 85. Daniels Arroyo is a good example.	Generally located on course-textured substrates, but also occurs on gravelly silty loams.
Mountain Xeroriparian Scrub	Characteristic vegetation is highly variable but typically consists of paloverdes, ironwood, mesquites, and succulents.	Found in narrow linear strips in downcut channels with a moderate to dense layer of trees and shrubs that are generally less than 16 feet tall. Herbaceous layer typically is sparse.	Channel-constricted flow is the dominant ecological process.	This community is found on upper *bajadas* and low- to moderate-elevation mountain slopes with more than a 6 percent grade.	May be on exposed bedrock on upper mountain slopes. Soils are generally not saline.

Figure 2.3: BMGR East Natural Communities as Assessed by TNC

Barry M. Goldwater Range (BMGR)

2018-2023 Integrated Natural Resource Management Plan (INRMP)



Legend

- City/Town
- Interstates
- Highways
- BMGR East
- BMGR West
- Gila Bend AFAF
- Cabeza Prieta NWR
- Sonoran Desert NM
- Tohono O'odham Nation
- BLM
- State Trust Land

BMGR Natural Communities

- Developed
- Creosote Bush - Big Galleta Scrub
- Creosote Bush-White Bursage Desert Scrub
- Desert Playa
- Dune Complex and Dune Endemic
- Paloverde-Mixed Cacti Scrub on Bajadas
- Paloverde-Mixed Cacti-Mixed Scrub on Rocky Slopes
- Sand Tank Mountains Palo Verde-Mixed Cacti-Mixed Scrub
- Valley Bottom Floodplain Complex

World Geodetic System
1984 (WGS84) Projection
Zone 12N
GCS_WGS_1984

Base data from ESRI StreetMap
Hillshade derived from USGS NED

Created By:
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Southwest Arizona Seamless Mapping Effort

In 1981, the NPS developed a vegetation map for the Organ Pipe Cactus NM following the protocol developed by P.L. Warren and others from the UA (Malusa and Sundt 2015). Since this time, an effort has been underway to map all connecting federal land management entities following the same standardized protocol through the support of the Desert Southwest Cooperative Ecosystem Studies Unit and UA. Completed mapping units include the BMGR West, Organ Pipe Cactus NM, Cabeza Prieta NWR and BLM lands in the Ajo Block, and portions of the BMGR East (Malusa 2003; McLaughlin et al. 2007; Osmer et al. 2009; Malusa 2010; Shepherd 2011; Whitbeck 2013; Malusa and Sundt 2015; Weston and Fehmi 2016). Approximately 100,000 acres of the BMGR East remains to be mapped. When the remaining portions of the BMGR East are completed in FY 2019, one cohesive map will be produced for all mapped federal lands within southwestern Arizona using a common methodology and common mapping units. This seamless map will provide a baseline for ecosystem management decisions and be a useful tool for land and resource managers to better understand how wildlife species are utilizing the landscape and associated vegetation.

The maps classify vegetation communities following the U.S. National Vegetation Classification System (USNVC). The hierarchical framework of the USNVC documents community alliances and associations. Alliance is the broadest level of classification used for vegetation mapping and is defined by a characteristic range of species composition, habitat conditions, physiognomy, and diagnostic species, typically where at least one is found in the uppermost or dominant stratum of the vegetation layer (USNVC 2017). Alliances reflect regional climate, hydrologic, substrate, and disturbance regimes and trends (USNVC 2017). Communities are typically mapped at a finer-scale-association level that is based on the characteristic range of species composition, diagnostic species occurrence, habitat conditions, physiognomy, and local climatic, hydrologic, and disturbance regimes and trends (USNVC 2017). Occasionally, vegetation communities are mapped down to the subassociation level, whereas an association typically occurs with a particular landform, such as with White Bursage-Big Galleta Grass on Dunes (Malusa and Sundt 2015).

BMGR East

Detailed mapping was conducted by the UA in five phases (Table 2-10, Figure 2.4). The first phase began in 2003 with the mapping of the NTAC and STAC (McLaughlin et al. 2007). Next the ETAC Range and Area B were mapped, then the western San Cristobal Valley, and then the eastern San Cristobal Valley, Aguila Mountains, and Sentinel Plain (Osmer et al. 2009; Shepherd 2011; Whitbeck 2013; Weston and Fehmi 2016). To complete the remaining portions of the comprehensive vegetation-association mapping effort, the following areas are scheduled to be mapped over the course of FY 2018 and FY 2019.

- Approximately 11,000 acres along the "stair-step" boundary between the easternmost portion of the range and the Sonoran Desert NM.
- Approximately 90,000 acres identified as having a slope greater than 20 percent were deemed less suitable for Sonoran pronghorn and were not mapped to reduce costs. As of February 2018, the remaining areas to be mapped are accounted for within the Brittlebush (*Encelia farinose*) – Creosote – White Bursage / Yellow Paloverde association.

Table 2-10: BMGR East vegetation associations.

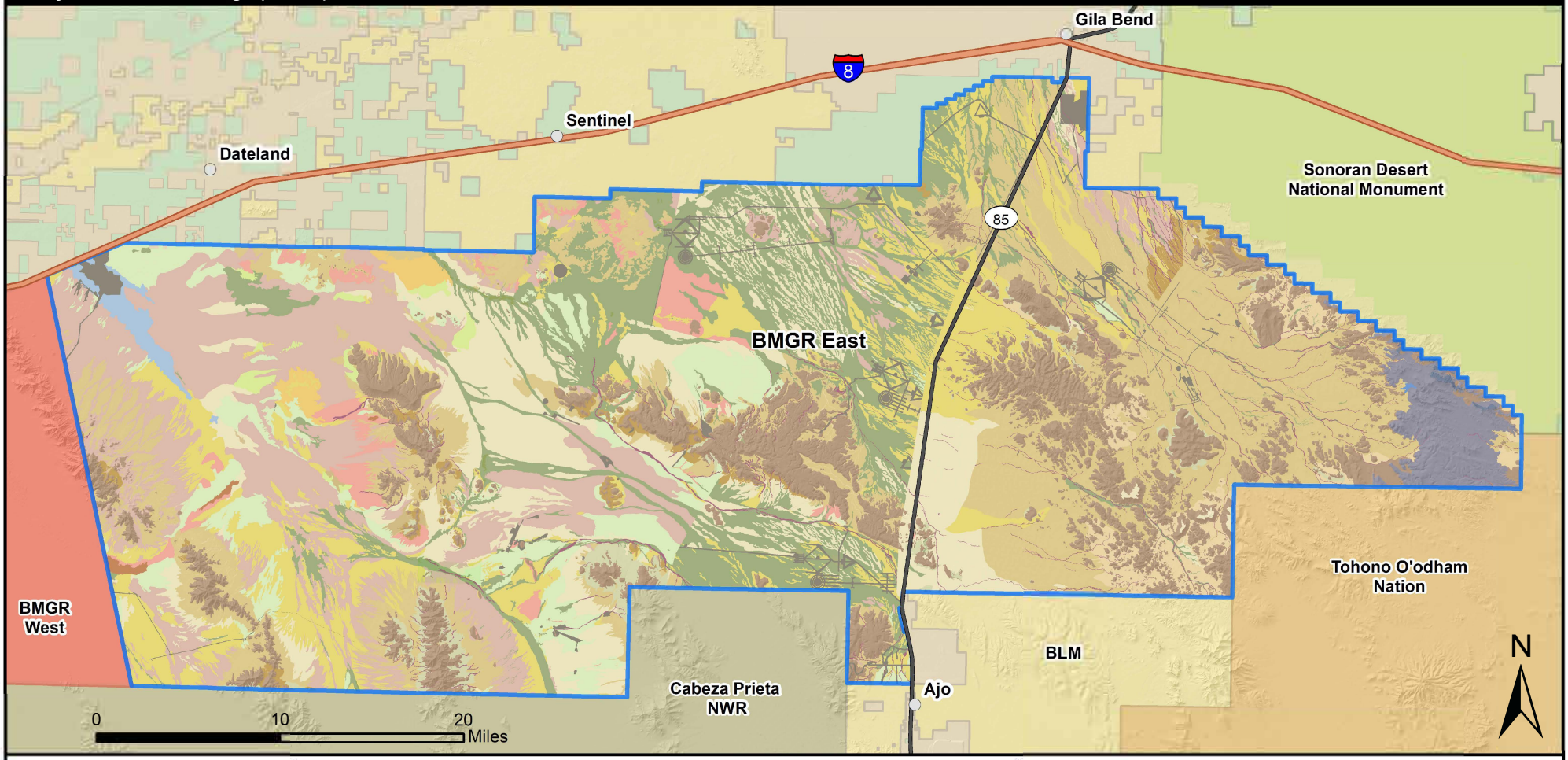
Vegetation Association[1]	Total Acres
Creosote / Paloverde – Ironwood	221,645
Creosote / Triangle Leaf Bursage	148,356
Creosote Floodplain	135,891
Creosote – White Bursage – Triangle Leaf Bursage	114,980
Creosote Monotype	110,577
Brittlebush (*Encelia farinose*) – Creosote – White Bursage / Yellow Paloverde (90,000 acres unsurveyed)	135,513
Creosote – White Bursage	55,264
>20 percent Slopes or Mountains	29,943
Bursage / Creosote – Wolfberry (*Lycium* spp.) / Paloverde	23,529
Mountain Uplands	20,522
Creosote – White Bursage – Big Galleta Grass	19,459
Disturbed	14,647
White Bursage – Creosote – Teddy Bear Cholla (*Cylindropuntia bigelovii*)	11,846
Creosote – Teddy Bear Cholla	9,905
Wolfberry	8,074
Creosote – Fagonia (*Fagonia* spp.) – White Bursage	5,715
Saltbush (*Atriplex* spp.) – Slender Saltbush (*A. tenuissima*) – Creosote	5,393
Creosote / Desert Saltbush (*A. polycarpa*) / Mesquite	4,165
Bursage spp. / Creosote / Yellow Paloverde / Ironwood	2,318
White Bursage / Big Galleta Grass / Creosote	1,199
White Bursage – Creosote	943
Jojoba (*Simmondsia chinensis*) / Lycium Mountains	872
Mesquite – Paloverde	817
Honey Mesquite (*P. glandulosa*) *Playa*	88
Brittlebush Terrace	71
Barren	51

[1] Forward slashes (/) separate different strata; the en-dashes (–) separate species within a stratum

Figure 2.4: BMGR East Vegetation Community

Barry M. Goldwater Range (BMGR)

2018-2023 Integrated Natural Resource Management Plan (INRMP)



Legend

- City/Town
- Interstate 8
- State Route 85
- BMGR East
- BMGR West
- Cabeza Prieta NWR
- Sonoran Desert NM
- Tohono O'odham Nation
- BLM
- State Trust Land

BMGR East Vegetation Associations

- 0 - Barren
- 10 - Creosote Monotype
- 11 - Creosote - White Bursage
- 12 - Creosote - Triangle Leaf Bursage
- 13 - Creosote - White Bursage - Triangle Leaf Bursage
- 14 - Creosote - Teddy Bear Cholla
- 15 - Creosote Floodplain
- 16 - Creosote - White Bursage - Big Galleta Grass
- 17 - Creosote / Palo Verde - Ironwood
- 18 - Creosote / Desert Saltbush / Mesquite
- 19 - Creosote - Fagonia - White Bursage
- 21 - Bursage / Creosote - Wolfberry / Palo Verde
- 24 - White Bursage - Creosote - Teddy Bear Cholla
- 25 – Bursage spp. / Creosote / Yellow Palo Verde / Ironwood
- 26 - White Bursage / Big Galleta Grass / Creosote
- 28 - White Bursage - Creosote
- 30 - Jojoba / Lycium Mountains
- 31 - Mountain Uplands
- 50 - Disturbed
- 60 - Brittlebush Terrace
- 63 - Brittlebush - Creosote - White Bursage / Yellow Palo Verde
- 70 - Saltbush - Slender Saltbush - Creosote
- 80 - Mesquite - Palo Verde
- 81 - Wolfberry
- 82 - Honey Mesquite Playa

World Geodetic System
1984 (WGS84) Projection
Zone 12N
GCS_WGS_1984

Base data from ESRI StreetMap
Hillshade derived from USGS NED

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BMGR West

Vegetation mapping efforts began in 2009 and were completed in 2014 (Malusa 2010; Malusa 2012; Malusa and Sundt 2015; Figure 2.5). The majority of the BMGR West is part of Mojave-Sonoran Semi-Desert Scrub Macrogroup, which covers most of the Mojave and Sonoran deserts in the Southwestern U.S. Within this macrogroup, there are six alliances, including creosote, bursage, saltbush, brittlebush, watercourse, and blue paloverde. Within these alliances are 23 associations, such as Creosote–Teddy Bear Cholla. Finally, within these associations are 40 subassociations, the most detailed mapping unit.

The remainder of the BMGR West falls under the Great Basin & Intermountain Dry Shrubland & Grassland Macrogroup. This vegetation is characterized by shrubs like Mormon tea (*Ephedra viridis*) and is restricted to the north slopes of the higher mountains. On the BMGR West, this macrogroup comprises one alliance, two associations, and two subassociations (Malusa and Sundt 2015). Figure 2.5 depicts the BMGR West vegetation communities mapped at the association level. The 2015 report, *Vegetation Mapping of the Barry M. Goldwater Range West, Marine Corps Air Station-Yuma, Arizona* (Malusa and Sundt 2015), provides a detailed description of the mapped vegetation subassociations. Table 2-11 lists and quantifies the broadly categorized vegetation associations (Malusa and Sundt 2015).

Table 2-11: BMGR West vegetation associations.

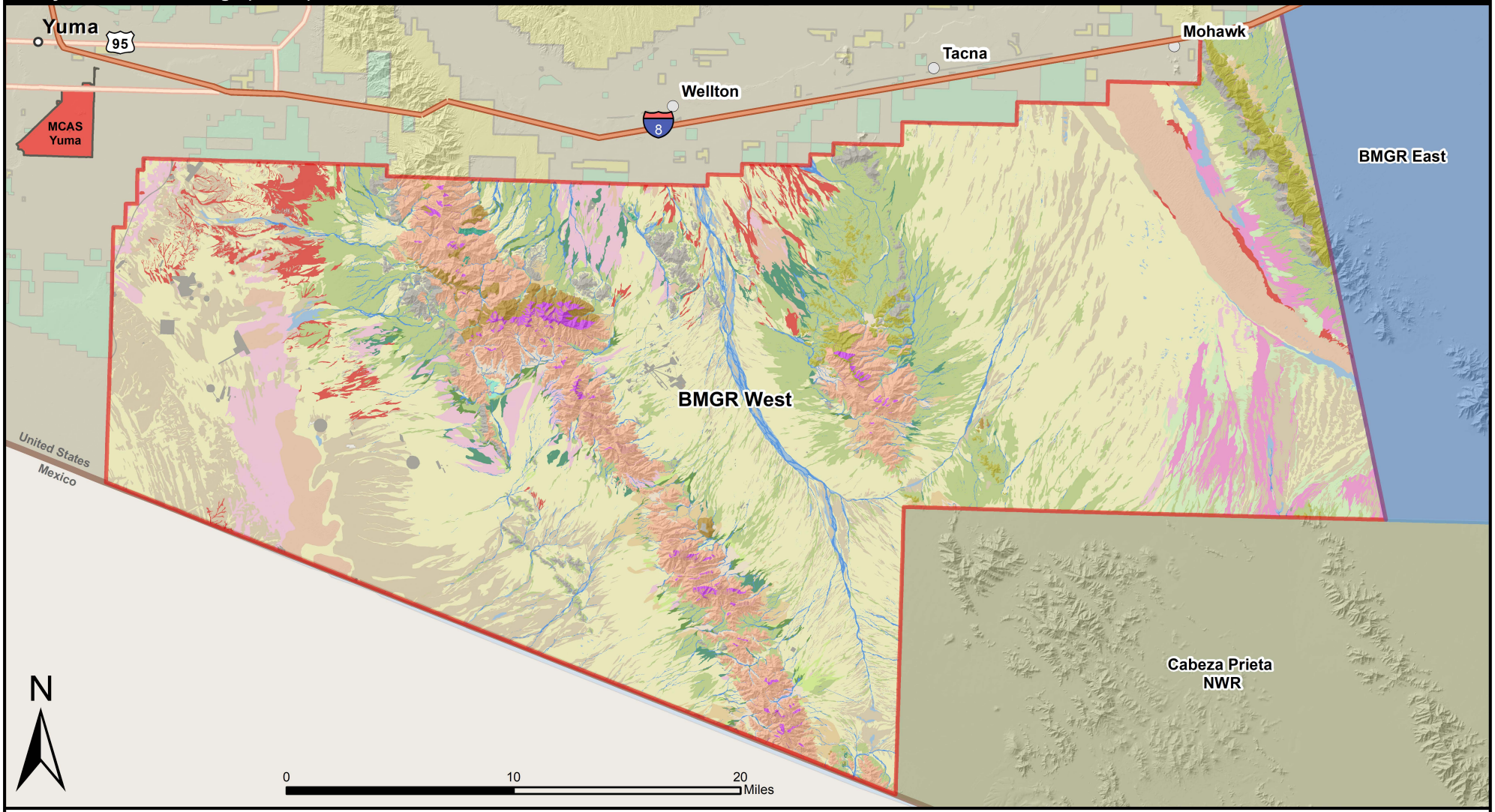
Vegetation Association[1]	Total Acres
Creosote – White Bursage	275,715
Creosote – Bursage / Paloverde – Ironwood	97,543
Creosote Monotype	96,401
White Bursage – Elephant Tree	49,096
White Bursage – Big Galleta Brass	28,040
White Bursage – Creosote	26,403
Wolfberry	15,082
Creosote – Triangle Leaf Bursage	14,252
Creosote – White Bursage – Big Galleta Grass	13,639
Creosote – Fagonia – White Bursage	11,984
Creosote – White Bursage – Triangle Leaf Bursage	10,629
Brittlebush – Creosote – White Bursage / Yellow Paloverde	10,073
Creosote – Teddy Bear Cholla	9,867
Creosote Floodplain	6,256
White Bursage – Creosote / Paloverde / Ironwood	5,687
Disturbed	4,155
Brittlebush – Creosote	4,075
White Bursage – Creosote – Teddy Bear Cholla	3,949
Mormon Tea – Agave (*Agave* spp.) / White Bursage	2,864
Brittlebush – Ironwood – Blue Paloverde	2,600
Arrowleaf (*Pleurocoronis pluriseta*) / Sumac (*Rhus* spp.) / Beargrass (*Nolina microcarpa*) / Mormon Tea	1,937
Brittlebush – White Bursage – Creosote	1,934
Barren	911
Lavender (*Hyptis emoryi*) – Holly Leaf Bursage (*A. ilicifolia*)	444
Blue Paloverde / Holly Leaf Bursage	263
Desert Holly (*A. hymenelytra*) – White Bursage	147
Mesquite – Paloverde Bosque	19

[1] Forward slashes (/) separate different strata; the en-dashes (–) separate species within a stratum.

Figure 2.5: BMGR West Vegetation Community Map

Barry M. Goldwater Range (BMGR)

2018-2023 Integrated Natural Resource Management Plan (INRMP)



Legend

- Interstate 8
- Highways
- City/Town
- BMGR East
- BMGR West
- MCAS Yuma
- Cabeza Prieta NWR
- BLM
- State Trust Land

BMGR West Vegetation Associations

- 0 - Barren
- 10 - Creosote Monotype
- 11 - Creosote-White Bursage
- 12 - Creosote-Triangle Leaf Bursage
- 13 - Creosote-White Bursage-Triangle Leaf Bursage
- 14 - Creosote-Teddy Bear Cholla
- 15 - Creosote floodplain
- 16 - Creosote-White Bursage-Big Galleta Grass
- 17 - Creosote-Bursage/Palo Verde-Ironwood
- 19 - Creosote-Fagonia-White Bursage
- 24 - White Bursage-Creosote-Teddy Bear Cholla
- 26 - White Bursage-Big Galleta Grass
- 27 - White Bursage-Elephant Tree
- 28 - White Bursage-Creosote
- 29 - White Bursage-Creosote/Palo Verde/Ironwood
- 40 - Mormon Tea-Agave/White Bursage
- 41 - Arrowleaf/Sumac/Beargrass/Mormon Tea
- 50 - Disturbed
- 63 - Brittlebush-Creosote-White Bursage/Yellow Palo Verde
- 67 - Brittlebush-Creosote
- 68 - Brittlebush-White Bursage-Creosote
- 69 - Brittlebush-Ironwood-Blue Palo verde
- 71 - Desert Holly-White Bursage
- 80 - Mesquite-PaloVerde
- 81 - Wolfberry
- 83 - Lavender-Hollyleaf Bursage
- 90 - Blue Palo verde/Hollyleaf Bursage

World Geodetic System
1984 (WGS84) Projection
Zone 11N
GCS_WGS_1984

Base data from ESRI StreetMap
Hillshade derived from USGS NED

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2.3.2.3 Future Vegetative Cover

Desert habitats are sensitive to changes in the climate that exacerbate existing hot and dry conditions, which are especially extreme during April through June. Many species are vulnerable to these changes because they already exist close to their physiological limits. As such, even small changes in temperature and precipitation can have a significant impact on plant species composition in this region. Interacting disturbances (e.g., changes in flooding and wildfire) could further alter plant survival. Deserts are particularly vulnerable to invasive grasses, which can provide fuels for wildfire. Ultimately, this combination of shifting conditions and invasive grasses could lead to conversion from a desert to grassland system (EcoAdapt 2017).

Future climate conditions are likely to expose vegetation at the BMGR to increased average air temperatures, changes in precipitation (Section 2.2.1.2), decreased soil moisture, more extreme high temperature events, and increased wildfire frequency and intensity (Section 7.9) over the coming century. Although predictions of monsoon activity in North America are highly uncertain (Bukovsky et al. 2013), more frequent and/or intense tropical storms could alter desert stream geomorphology and riparian vegetation communities, particularly in dry washes or floodplains (Section 2.2.4.1). Some habitat features (e.g., mesquite bosques) will likely benefit from the overall annual increases in precipitation due to seasonal rainfall (CEMML 2019).

Desert vegetation is expected to shift westward and upward in elevation over the coming century (Barrows 2011; Barrows and Murphy-Mariscal 2012), and, in some areas, may replace upslope vegetation that is less suited to the increasingly hot and seasonally dry conditions (Friggens et al. 2013; Lenihan et al. 2008).

2.3.2.4 Turf and Landscaped Areas

This section of the INRMP applies to installations that are developed. The BMGR is an undeveloped desert and none of the lands are landscaped or have turf. Gila Bend AFAF, on BMGR East, has several small turf areas and several rows of planted trees. Gila Bend AFAF is operated and maintained by a USAF Contractor and all turf and landscape areas are maintained by the contractor or sub-contractor as part of the service contract agreement. The total area of Gila Bend AFAF is 2,011 acres with less than 7 acres containing turf or landscaped areas.

2.3.3 Fish and Wildlife

Wildlife found at the BMGR is typical of that found in the Sonoran Desert ecosystem. Available inventories show that over 200 species of birds, over 60 mammal species, 50 species of reptiles and 10 amphibian species occur or may potentially occur within the BMGR and the adjacent Cabeza Prieta NWR. Due to the absence of permanent water sources, the occurrence of amphibians is limited and there are no fish. Evidence indicates that the diversity and population sizes of wildlife species and the amount of habitat have remained relatively stable and typical for this portion of the Sonoran Desert. This is attributed to that fact that land withdrawn for military use excludes or limits other land uses such as livestock grazing, farming, mining, and off-road vehicle recreation. Due to BMGR's large size and interconnectedness with two NMs and one NWR, as well as its distance from

metropolitan areas and anthropogenic impacts, the installation remains one of the last remaining large swaths of pristine Sonoran Desert.

Figure 2.6: AGFD conducts surveys for many species at BMGR, including flat-tailed horned lizard (left), Le Conte's thrasher (middle), and bighorn sheep (right).

Threats to wildlife populations and habitat include an increase in the number of trespass livestock. Vulnerabilities to wildfires (see Section 7.9) created by the expansion of invasive species and persistent, reoccurring droughts may be related to climate change. Threats to habitat and wildlife from illegal cross-border traffic have sharply diminished with the completion of the border barrier fence. Restrictions to military use or public recreation activities to protect or rehabilitate habitat have not been established.

2.3.3.1 Climate Impacts on Fish and Wildlife

Wildlife populations on the BMGR could be impacted by several climate change-related factors. Climate change will likely favor newly arriving species. These species may outcompete the native species that are already experiencing reduced fitness due to other environmental changes (Hellmann et al. 2008) such as hotter temperatures, longer periods of drought, increased winter precipitation, and more frequent flooding. Though the trend towards invasive species is a global one, it is expected to be far more pronounced in the Southwest, where many animals are already at their physiological limit in the desert climate (Archer et al. 2008).

Water scarcity is already an issue for wildlife populations at the installation, and this scarcity is likely to persist. Though models project increased precipitation, much of the precipitation will fall in the winter during brief, intense convectional storms. Increases in convectional storms during the winter have the potential to fill manmade wildlife catchment systems and certain natural tinajas. The increased storage may help water resources last into the more pronounced summer drought, particularly if protected from evaporation.

Greater frequency and intensity of wildfires resulting from a combination of more pronounced drought and changes in vegetation will likely lead to habitat destruction, increased erosion, and greater run off rates (see Section 7.9.1). These changes —combined with higher evapotranspiration rates due to rising temperatures—will reduce natural sources of water for wildlife (Archer et al. 2008). Although desert wildlife communities are highly adapted to hot, arid environments, some may not be able to cope with increases in temperature. Generalist species will likely be better able to

acclimate to rising temperatures through behavioral adaptations. For example, the Gila monster becomes nocturnal on hot days but remains diurnal on cooler days (Stahlschmidt et al. 2011).

Increasing temperatures will likely have a negative impact on water quality, particularly in lentic systems. As water temperatures rise, dissolved oxygen content will lower, decreasing habitat quality, particularly for larval amphibians. Increasing water temperature will also raise the chances of algal blooms occurring, further depleting dissolved oxygen content and habitat quality (Paerl et al. 2011).

A study conducted to the southeast of BMGR indicated that the density of woody shrubs has increased three-fold from the 1970's to the late 1990's in parts of the Sonoran Desert due to higher winter precipitation (Brown et al. 1997). This trend is likely to continue based on the precipitation patterns predicted in the climate models. Changing vegetation communities will likely have a negative impact on species that depend on specific native plants for their survival (Dukes and Mooney 1999). Other wildlife species may change in a less predictable manner. For example, the common chuckwalla—which is currently abundant in the region—is predicted to lose 92% of its habitat in the Sonoran Desert of California (Barrows 2011). The kangaroo rat (*Dipodomys deserti*) and silky pocket mouse (*Perognathus flavus*) populations have already declined significantly because of changing vegetation induced by climate change. On the other hand, rare species such as the desert pocket mouse (*Chaetodipus penicilatus*) and Bailey's pocket mouse (*Chaetodipus baileyii*) have responded positively to changing vegetation (Brown et al. 1997). As such, managers should take an ecosystem-based approach to prepare for a broad range of changes in wildlife populations due to the changing conditions.

2.3.4 Threatened and Endangered Species and Species of Greatest Conservation Need

There are currently two species listed under the ESA known to occur at BMGR: Sonoran pronghorn (*Antilocapra americana sonoriensis*) and acuña cactus (*Echinomastus erectocentrus* var. *acunensis*). For its continued survival, the pronghorn (see Section 7.4.1) depends on the Sonoran Desert ecosystem of the BMGR, Cabeza Prieta NWR, and Organ Pipe Cactus NM. The acuña cactus was federally listed as endangered in 2013 and is found mainly at BMGR East, Tohono O'odham Nation Reservations, BLM lands, Organ Pipe Cactus NM, and areas southeast of Phoenix (between Cactus Forest and Kearny). The lesser long-nosed bat, previously federally listed as endangered, was delisted in April 2018 (USFWS 2018).

The flat-tailed horned lizard (FTHL) (*Phrynosoma mcallii*) has no federal protection in the U.S., but it is listed as threatened in Mexico and is a Species of Greatest Conservation Need (SGCN) in Arizona and a species of concern in California. The FTHL occurs at BMGR West and is managed in accordance with the Candidate Conservation Agreement and the FTHL Rangewide Management Strategy (RMS), to which the USMC and AGFD are parties. The FTHL (see Section 7.4.4) occurs at the far western portion of the BMGR West and has been the subject of considerable ESA and federal court activities. Much of the FTHL's historical habitat (possibly as much as 50 percent) in the U.S. has been lost due to agricultural and residential development. In 2011, the USFWS withdrew its proposed listing, based in part on protections offered by the 2003 RMS (FTHL Interagency Coordinating Committee 2003). As a Signatory Agency, MCAS Yuma has incorporated RMS measures into this INRMP, including

participating as an FTHL Interagency Coordinating Committee member and conducting annual occupancy and demographic surveys and research.

The Sonoran desert tortoise (*Gopherus morafkai*) is not a federally listed species, but it is an Arizona SGCN. The BMGR applies conservation strategies as outlined in the Candidate Conservation Agreement which is discussed in more detail in Section 7.4.2 *Desert Tortoise Update*.

The fringe-toed lizard (*Uma rufopunctata*) is currently under review for federal listing, and more information is needed to determine whether listing is warranted. Recent genetic analysis confirmed that fringe-toad lizards from the Mohawk Dunes in southwestern Arizona should be classified as a distinct species, *Uma thurmanae* (Derycke et al. 2020). Discussions with AGFD Herpetologist and BMGR East & West Wildlife Biologists concluded that mapping fringe-toed lizard distribution, assessing the overall population status, and documenting existing and potential threats are the first steps needed to work towards a potential future Candidate Conservation Agreement.

Peirson's milkvetch (*Astragalus magdalenae peirsonii*) is listed as threatened. The plant is found primarily on the Algodones Dunes in California and the dunes of nearby Gran Desierto de Altar in northwestern Sonora, Mexico. On the BMGR, a single specimen collected in 1996 near the range's western boundary was thought to be Pierson's milkvetch; however, the specimen was subsequently assigned to a different subspecies. Peirson's milkvetch is not currently known to exist in Arizona, although suitable habitat exists in the Yuma Dunes at the BMGR West. The species was not detected on surveys conducted in 2003 and 2004 (BMGR Task Force 2005). The only Biological Opinion addressing effects of the BMGR military activities on Peirson's milkvetch was issued in 2001 (USFWS 2011). In this Opinion, the USFWS found that the actions proposed were not likely to jeopardize the continued existence of Peirson's milkvetch. The rationale for this conclusion was that relatively limited potential habitat existed and USMC activities were expected to only minimally affect those habitats (BMGR Task Force 2005). Although the species has not been found during any surveys to date, in accordance with the 2001 Biological Opinion, a re-initiation or consultation with the USFWS may be warranted if the species is found in the future.

Federally threatened and endangered species that have not been documented but have the potential to occur at BMGR are listed in Table 2-12. In addition, Arizona Status and Arizona's State Wildlife Action Plan (SWAP) score are listed.

2.3.4.1 Climate Impacts on Threatened and Endangered Species

Habitat change and disruption to food availability are two major threats to threatened and endangered species that have existed on the range for decades, and that could be further exacerbated by climate change. Changes in temperature and precipitation are likely to affect prey populations. The abundance of forage and seasonal cues may also change, resulting in a mismatch between food availability and food needs for some species. Populations of some threatened and endangered species are further imperiled by having life stages that are especially sensitive to temperature and precipitation changes. Habitat requirements may change for some species if they develop behavioral adaptations to changing environmental conditions (CEMML 2019).

The endangered Sonoran pronghorn and acuña cactus are likely to be further imperiled by the environmental changes predicted in climate models (CEMML 2019). Sonoran pronghorn require

large expanses of continuous habitat suitable for foraging, access to water, and predator detection and avoidance. Climate change will create added pressures on this species due to extended drought during the dry spring months coupled with hotter temperatures. These changes are likely to cause greater thermal stress, degrade foraging habitat, and reduce the availability of natural water resources (Gedir et al. 2015; USFWS 2010; USFS 2016). Similarly, the acuña cactus is vulnerable to increases in drought frequency and intensity and altered precipitation patterns (USFWS 2013). More prolonged drought may further reduce seed recruitment and adult survivorship (USFWS 2013) and shift flowering phenology (Bowers 2017).

Table 2-12: Threatened and Endangered Species and Species of Greatest Conservation Need (SGCN).

Common Name (*Scientific Name*)	Federal[1] Status	Arizona Status[2]/ SWAP Score[3]	Species of Greatest Conservation Need	Species or Habitat			Federal Register (FR) Reference	Habitat or Potential Habitat at BMGR
				Present	Potential	Not Expected		
Mammals[4]								
Lesser long-nosed bat (*Leptonycteris curasoae yerbabuena*)		SC/1A		✓			53 FR 38456, 30 September 1988; Petition to delist: 82FR 1665, 6 January 2017; Delisted 83FR 17093, 18 April 2018	Summer resident that roosts in caves or mines and forages in desert scrub habitats (BMGR East and West).
Spotted bat (*Euderma maculatum)*		SC/1B	✓		✓	✓		Riparian areas, rocky cliffs (BMGR West).
Southern yellow bat (*Lasiurus ega*)		SC/NR			✓	✓		In association with palm trees, may occur in vicinity (BMGR East and West).
California leaf-nosed bat *(Macrotus californicus*)		SC/1B	✓	✓				Year-round resident that roosts in caves or mines and forages in desert scrub or xeroriparian vegetation. (BMGR East and West).
Greater western mastiff bat (*Eumops perotis californicus*)		NR/1B	✓	✓				Lower and upper Sonoran desert scrub near cliffs, preferring the rugged rocky canyons with abundant crevices (BMGR East and West).
Sonoran pronghorn (*Antilocapra americana sonoriensis*)	LE	SC/1A	✓	✓			32 FR 4001, 1 March 1967	Southwestern Arizona: vegetation includes big galleta grass, six week three-awn, six weeks grama, creosote bush, bursage, and saltbush; BMGR West and East, east of the Gila and Tinajas Altas mountains (BMGR East and West).
Sonoran pronghorn (*Antilocapra americana sonoriensis*)	XN			✓			76 FR 25593, 5 May 2011	New breeding pen at Kofa NWR, relocation of some species from existing breeding pen at Cabeza Prieta NWR to BMGR East.
Canyon Mouse (*Peromyscus crinitus*)		NR/1C		✓				Rocky habitats or gravel sites adjacent to rocky areas (BMGR West).
Kit fox (*Vulpes macrotis*)		NR/1B		✓				In valleys and on sandy plains in the Southwestern deserts (BMGR East and West).
Little pocket mouse (*Perognathus longimembris*)		NR/1B		✓				Found in various types of desert scrub habitats (greasewood, rabbitbrush, creosote bush, cactus, mesquite, paloverde, etc.) (BMGR West).
Crawford's desert shrew (*Notiosorex crawfordi*)		NR/NA		✓				Not restricted to any particular vegetation type, so long as there is sufficient cover. They are often found in packrat houses, or under dead agaves, old logs, or other debris (BMGR West).
Desert bighorn sheep (*Ovis canadensis mexicana*)		NR/NA	✓	✓				Desert mountain ledges and grassy basins (BMGR East and West).
Arizona wood rat (*Neotoma devia*) (on the list provided by MCAS Yuma, but not on the AZ SGCN list)				✓				Low desert or rocky slopes; sagebrush scrub or areas with scattered cactus, yucca, and other low vegetation. When inactive, occupies elaborate den built of debris among cacti, rocks, etc. Found only in extreme western Arizona (BMGR West).
Birds[5]								
Southwestern willow flycatcher (*Empidonax traillii extimus*)	LE	SC/1A	✓			✓	60 FR 10693, 27 February 1995; Designation of critical habitat: 78 FR 343, 3 January 2013	Well-developed riparian areas with cottonwood, willow, or tamarisk are not present.
Yuma clapper rail (*Rallus longirostris yumanensis*)	LE	SC/1A	✓			✓	32 FR 4001, 11 March 1967	Marsh habitat not found at BMGR.

Table 2-12: Threatened and Endangered Species and Species of Greatest Conservation Need (SGCN).

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				Present	Potential	Not Expected		
Bald eagle (*Haliaeetus leucocephalus*)	BGEPA	SC/1A	✓			✓	Proposed for delisting: 64 FR 36453, 6 July 1999; Delisting: 72 FR 37346, 9 July 2007	Aquatic habitat not found at BMGR.
Golden eagle (*Aquila chrysaetos canadensis*)	BGEPA	NA/1A		✓				Cliffs or in large trees that afford an unobstructed view (BMGR East).
Sprague's pipit (*Anthus spragueii*)		SC/1A	✓		✓			Winters in grassy fields along lower Colorado River from north of Yuma to Parker (may be expected occasionally at BMGR West).
Cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*)		SC/1A	✓		✓			Xeroriparian areas (BMGR East and West).
Peregrine falcon (*Falco peregrinus anatum*)		SC/1A	✓		✓			Isolated cliffs; winter migrant (BMGR East and West).
Ferruginous hawk (*Buteo regalis*)		SC/1B	✓	✓				Arid to semiarid regions, as well as grasslands and agricultural areas (BMGR East).
Belted kingfisher (*Ceryle alcyon*)		SC/NA	✓		✓			Found near water (fresh or salt); rare transient at BMGR.
Crested caracara (*Caracara cheriway*)		SC/NA	✓		✓			Semi-desert, in both arid and moist habitats, but is more common in the former. Observed in Sonoran Desert NM near BMGR East.
Snowy egret (*Egretta thula*)		SC/NA	✓		✓			Marshes, lakes, ponds, lagoons, mangroves, and shallow coastal habitats; may appear during seasonal migration (BMGR East and West).
Tropical kingbird (*Tyrannus melancholicus*)		SC/NA	✓		✓			Situations with scattered trees, savanna, open woodland, forest edge, plantations, residential areas and agricultural lands.
Desert Purple Martin (*Progne subis Hesperia*)		NR/1B	✓	✓				Desert Southwest in saguaro cacti cavities (BMGR East).
Gila woodpecker (*Melanerpes uropygialis*)		NR/1B		✓				All desert habitats, nesting in saguaro cacti (BMGR East and West).
Gilded flicker (*Colaptes chrysoides*)		NR/1B		✓				All desert habitats, nesting in saguaro cacti (BMGR East and West).
Le Conte's Thrasher (*Toxostoma lecontei*)		NR/1B	✓	✓				Open desert scrub, alkali desert scrub, and desert succulent scrub (BMGR East and West).
Mountain plover (*Charadrius montanus*)		NR/1B	✓	✓				Xeric or disturbed uplands; short vegetation, bare ground, and a flat topography. Not on the AGFD Heritage Data Management System for Maricopa, Pima, and Yuma counties. However, known to occur on BMGR East, and surveys in 2011 and early 2012 identified the plover in Maricopa County (Gila Bend AFAF), and Yuma County.
Bendire's thrasher (*Toxostoma bendirei*)		NR/1C		✓				Relatively open desert grassland, shrubland or woodland with scattered shrubs or trees (BMGR East and West).
Black-tailed gnatcatcher (*Polioptila melanura*)		NR/1C		✓				Desert brush, dry washes, and mesquite *bosques* (BMGR East and West).
Brown-crested flycatcher (*Myiarchus tyrannulus*)		NR/1C		✓				Found in association with saguaros; also frequents river groves and other areas where trees are large enough to provide sites for cavity nesting (BMGR East).

Table 2-12: Threatened and Endangered Species and Species of Greatest Conservation Need (SGCN).

Common Name (*Scientific Name*)	Federal[1] Status	Arizona Status[2]/ SWAP Score[3]	Species of Greatest Conservation Need	Species or Habitat			Federal Register (FR) Reference	Habitat or Potential Habitat at BMGR
				Present	Potential	Not Expected		
Common poorwill (*Phalaenoptilus nuttallii*)		NR/1C		✓				In all Sonoran Desert habitats, but most common on sparsely vegetated *bajadas* (BMGR East and West).
Costa's hummingbird (*Calypte costae*)		NR/1C		✓				Desert and semi-desert, arid brushy foothills, chaparral; in migration and winter also in adjacent mountains and in open meadows and gardens (BMGR East and West).
Elf owl (*Micrathene whitneyi*)		NR/1C		✓				Deserts, dry shrublands, riparian woodlands, and open pine-oak forests (BMGR East and West).
Gray vireo (*Vireo vicinior*)		NR/1C		✓				Non-breeding winter resident found in desert and arid scrub, semi-open areas with scattered scrub and semi-open arid brushland (BMGR West). Observed during migration (BMGR East).
Hooded oriole (*Icterus cucullatus*)		NR/1C		✓				Favors groups of palms for nesting. (BMGR East).
Lucy's warbler (*Vermivora luciae*)		NR/1C			✓			Mesquite *bosques* and edges of riparian woods in desert zones (BMGR East and West).
Phainopepla (*Phainopepla nitens*)		NR/1C		✓				Scrub habitats, with desert mistletoe present for foraging (BMGR East and West).
Prairie falcon (*Falco mexicanus*)		NR/1C		✓				Canyons, open country, grasslands, and deserts (BMGR East and West).
Scott's Oriole (*Icterus parisorum*)		NR/1C		✓				Yucca gardens on desert grassland prairies, but they have been found wherever yucca is growing, even on the hillsides of mountain canyons (BMGR East and West).
Varied bunting (*Passerina versicolor*)		NR/1C		✓				Streamside thickets, brush mostly in areas of dense thorny brush, often with an upper story of scattered trees (BMGR East).
Western screech-owl (*Megascops kennicottii*)		NR/1C		✓				Southern populations inhabit lowland riparian forests, oak-filled arroyos, desert saguaro and cardon cacti stands, Joshua tree and mesquite groves, and open pine and pinyon-juniper forests (BMGR East and West).
White-throated swift (*Aeronautes saxatalis*)		NR/1C		✓				Rocky cliffs and canyons, typically found nesting in arid regions, but near major rivers (BMGR East and West).
Pyrrhuloxia (*Cardinalis sinuatus*)		NR/NA		✓				Desert scrub and mesquite thickets (BMGR East).
Reptiles								
Colorado Desert fringe-toed lizard (*Uma notata*)		NR/NA1		✓				Restricted to sparsely vegetated windblown sand dunes and sandy flats; it requires fine, loose sand for burrowing; vegetation is usually scant, consisting of creosote bush or other scrubby growth (BMGR East and West).
Yuman Desert fringe-toed lizard (*Uma rufopunctata*)		SC/NR	✓	✓			Listed as Candidate: 80 FR 56423, 18 September 2015	Restricted to sparsely vegetated windblown sand dunes and sandy flats; it requires fine, loose sand for burrowing; vegetation is usually scant, consisting of creosote bush or other scrubby growth (BMGR East and West).
Flat-tailed horned lizard (*Phrynosoma mcallii*)		SC/1A	✓	✓			Withdrawal of proposal to list: 76 FR 14210, 15 March 2011	Creosote flats, sand dunes, and mud hills in southeastern California, southwestern Arizona, and northwestern Mexico (BMGR West).

Table 2-12: Threatened and Endangered Species and Species of Greatest Conservation Need (SGCN).

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				Present	Potential	Not Expected		
Desert rosy boa (*Lichanura trivirgata gracia*)	SC	NR/NA	✓	✓				Rocky areas in desert ranges, especially in canyons with permanent or intermittent streams (BMGR West).
Mexican rosy boa (*Lichanura trivirgata trivirgata*)	SC	NR/NA	✓	✓				On or near rocky mountains or hillsides in desert ranges, where they inhabit the granite rock outcroppings that absorb the sun's rays providing heat and cover (BMGR West).
Desert Tortoise (Sonoran population) (*Gopherus morafkai*)		SC/1A	✓	✓				Sonoran desertscrub and semidesert grassland, prefers rocky slopes and *bajadas* (BMGR East).
Desert night lizard (*Xantusia vigilis*)		SC in Mohave County only / NA		✓				Arid and semiarid, among fallen leaves and trunks of yuccas, agaves, cacti, and other large plants, also in crevices of rock outcroppings and under logs and bark of foothill pines; it ranges locally into pinyon-juniper, sagebrush-blackbrush, and chaparral-oak. (BMGR West).
Long tailed brush lizard (*Urosaurus graciosus*)		NR/NA		✓				The Lower Colorado River Sonoran Desert scrub community and can be a common sight in creosote bush- lined desert flats with sandy soil and along tree lined drainages (BMGR West).
Amphibians								
Western (or Great Plains) narrow-mouthed toad (*Gastrophryne olivacea*)		SC/1C	✓		✓			Moist crevices or burrows, near ephemeral water sources (BMGR East and West).
Plants								
Acuña cactus (*Echinomastus erectocentrus* var. *acunensis*)	LE	HS		✓			81 FR 14058, 16 March 2016; Designation of critical habitat: 81 FR 55265, 18 August 2017	The Arizona Upland Subdivision of the Sonoran Desert scrub biotic community, tending to be located at the western, warmer, drier perimeter of the Subdivision within the Paloverde Saguaro Association; at least three distinct clusters of an acuña cactus exist in the BMGR East (Urreiztieta 2013, Abbate 2017); the species has not been detected in the BMGR West, nor is it expected to occur.
Peirson's milkvetch (*Astragalus magdalenae* var. *peirsonii*)	LT				✓		63 FR 53596, 6 October 1998; Designation of critical habitat: 64 FR 47329, 4 August 2004; Petition to remove from listing—not warranted: 73 FR 41007, 17 July 2008	Slopes of mobile sand dunes in the Sonoran desert scrub plant community. No confirmed occurrences but Yuma Dunes in the BMGR West are potential habitat.
Sand food (*Pholisma sonorae*)		HS		✓				Drifting sand below 500 ft. elevation in creosote bush scrub (Yuma Dunes in the extreme southwestern portion of the BMGR West).

[1] **Federal Status: BGEPA**=Bald and Golden Eagle Protection Act, **LE**=Endangered (U.S. Fish and Wildlife Service), **LT**=Threatened (U.S. Fish and Wildlife Service), **MBTA**=Migratory Bird Treaty Act, **NL**=Not listed, **SC**=Species of Concern (U.S. Fish and Wildlife Service), **XN**=Experimental non-essential population.

[2] **Arizona Status: HS**=Highly Safeguarded, **SC**=Species of Concern, **NA**=Not Applicable, NR=Not Rated.

[3] **Arizona State Wildlife Action plan (SWAP) score (species' vulnerability): 1A**=Scored 1 for vulnerability in at least one of eight vulnerability categories and matches at least one of the following: federally listed as E, T, or Candidate species; specifically covered under a signed conservation agreement or a signed conservation agreement with assurance; recently delisted federally and requires post-delisting monitoring;; closed-season species (i.e., no take permitted), as identified in Arizona Game and Fish; **1B**=Scored 1 for vulnerability, but matches none of the criteria listed under 1A; **1C**=Unknown status species.

[4] The Yuma puma has been omitted from the table; it had been listed as a wildlife species of concern, but genetic research completed after the list of wildlife species of concern was created showed that the subspecies ranking was incorrect.

[5] A list of migratory birds protected by the Migratory Bird Treaty Act can be found at 50 CFR 10.13.

2.3.5 Wetlands and Floodplains

Broad floodplains are associated with the major washes, which generally flow down the axes of the valleys between adjacent ranges (Klawon and Pearthree 2001). Wide floodplains are composed of mainly sand, silt, and clay, with gravelly channel deposits. These floodplains are subject to short-term flash flooding from storm events. Although flood hazards exist, the Federal Emergency Management Agency has not delineated 100-year floodplains (56 FW 2010).

Due to low amounts of precipitation in the Southwest, xeroriparian communities exist there rather than typical wetland communities. Xeroriparian areas are typically dry wash sites with denser vegetation communities than those of the surrounding desert. Larger washes are generally lined with mesquite, ironwood, paloverde, and a variety of other trees, shrubs, and herbaceous plants, whereas smaller washes may have just an occasional tree or simply contain larger trees than the surrounding plant community (BLM 2000). Xeroriparian areas are important habitats for wildlife species. Large and small mammals depend on these areas for forage and cover. Birds depend on them for nesting, forage, and predator avoidance, and they use them heavily during migration (BLM 2000).

BMGR East

Ephemeral washes include Sauceda Wash, Quilotosa Wash, Tenmile Wash, Midway Wash, and Growler/San Cristobal Wash. These systems have many large and small tributaries that are dry except after rare heavy or prolonged rain events (BLM 2000).

With the exception of Midway Wash, all of the ephemeral washes, Sauceda Wash, Quilotosa Wash, Tenmile Wash, San Cristobal/Growler Wash, on the BMGR East flow to the Gila River. These systems have many large and small tributaries that are dry except after heavy or prolong precipitation events. Xeroriparian areas, consisting of mesquite bosques, along with ironwood, paloverde, and a variety of other trees, shrubs, and herbaceous plants, are found along Growler Wash, San Cristobal Wash, Tenmile Wash, and Midway Wash.

BMGR West

The Mohawk Valley is a large arroyo that runs along the valley's axis and eventually dissipates into progressively smaller inland deltas. These deltas drain north but never reach the Gila River as coherent channels do (Malusa and Sundt 2015).

In contrast, the Coyote Wash is a single arroyo, with islands of floodplains, which run along the entire 31 miles of the Lechuguilla Valley (Malusa and Sundt 2015). Historically, Coyote Wash joined the Gila River at the town of Wellton, but it now ends at the berm that protects the Wellton Mohawk Canal. The wash is an important feature that provides habitat for both xeroriparian plant species and wildlife (Malusa and Sundt 2015).

2.3.5.1 Climate Impacts on Wetlands

Typical wetland communities on the BMGR do not exist. The Mohawk Valley arroyo and Coyote Wash are both xeroriparian communities, which may benefit from the increased levels of seasonal precipitation and inundation projected in climate models. On the other hand, warmer temperatures

may compensate for increases in precipitation via increased evaporation, particularly during drier months (CEMML 2019). In addition, climate change is likely to affect these systems via increased erosion due to concentrated storm events.

2.3.6 Other Natural Resource Information

N/A

2.4 Mission Impacts on Natural Resources

2.4.1 Natural Resource Constraints to Mission and Mission Planning

Natural resource constraints on the mission and mission planning include a combination of factors. Federal and state environmental laws and regulations, as well as physical and ecological factors can affect the use of the range and other facilities. Similarly, conservation measures included in biological opinions and conservation agreements can constrain military operations.

Operations and development on much of BMGR are affected by the presence of Sonoran pronghorn. Due to its endangered status, all actions at BMGR that may affect Sonoran pronghorn must undergo section 7 (of the ESA) consultation. Approximately 70 percent of BMGR East and 36 percent of the BMGR West are within Sonoran pronghorn habitat (Figures 7.4 and 7.5). At BMGR East, air and ground operations on the NTAC, STAC, and Range 1 are affected by the presence of animals in the vicinity of targets and along roads, and in any proposed development or expansion of facilities on these ranges or below the air-to-air range (generally throughout the area west of SR-85). These operations must take into account their potential impacts on pronghorn habitat and species recovery. In order to enhance fawn recruitment, the 56 FW schedules range maintenance and explosive ordnance clearances on NTAC and STAC outside the fawning season.

Concerted efforts of the USAF, USMC, AGFD, USFWS, and other members of the recovery team have resulted in improved status of Sonoran pronghorn through the implementation of numerous recovery actions (e.g., habitat protection and enhancements, establishment of a non-essential experimental population, construction and maintenance of wildlife waters). These and other actions are part of the recovery plan and, if successful, will lead to downlisting and, ultimately, delisting of the species. In the interim, however, the increased numbers of animals on the range has the potential to increase mission constraints. On the BMGR East, daily monitoring of target areas on NTAC, STAC, and Range 1 typically results in closing several targets to ordnance delivery for the day because of the presence of one or more animals in the immediate vicinity. It is anticipated that target closures will increase with population increases, and this will further constrain mission execution unless procedures currently in place evolve to mitigate this effect. That said, the USFWS has worked with the military to reduce mission constraints. For example, in 2010, the USFWS issued a non-jeopardy biological opinion with authorized incidental take of multiple pronghorn. The opinion allowed for reduced target closure distances to reduce constraints on the military, while still minimizing risks to pronghorn from military operations. Additionally, the USFWS has provided feed and water near the range boundaries (east, west, and south) in an attempt to lure pronghorn away from actively used targets. These activities are discussed in detail in Section 7.4.1 *Sonoran Pronghorn*.

Under the terms of a 2016 Candidate Conservation Agreement (USFWS et al. 2015), the 56 FW and MCAS Yuma agreed to implement measures to protect the Sonoran Desert tortoise (see Section 7.4.2) and its habitat. The current tortoise distribution includes all of BMGR. The provisions of the INRMP, especially road and vehicle travel management, contribute to the protection of the species. Both USAF and USMC travel management services are committed to keeping off-road vehicle use to the minimum required for range maintenance and operations. Another agreed-upon measure identified in the Candidate Conservation Agreement is to schedule explosive ordnance clearances and range maintenance in sensitive areas at BMGR East (primarily the ETAC Range) during seasons when the tortoise is less active. Combined with the scheduling constraints imposed by avoiding the pronghorn fawning season, this restriction precludes significant flexibility in scheduling tactical range clearance and maintenance closures.

Birds and wildlife represent significant threats to flight safety and can impact the timing of aircraft operations and training. Bird/Wildlife Aircraft Strike Hazard (BASH) concerns are greatest during landings or takeoffs or when aircraft fly at low altitudes, rather than during in-flight operations that are typical at the BMGR. A BASH Reduction Plan is in place at the BMGR East and West and is discussed in detail in Section 7.12 *Bird/Wildlife Aircraft Strike Hazard*.

The invasion of Sahara mustard, primarily in the BMGR West, has the potential to limit ground or air-to- ground based training in areas where it forms dense monocultures. These monocultures can be a fuel source, increasing fire danger when there are ignition sources such as vehicles and air-to-ground artillery. The spread of Sahara mustard is currently being controlled through mechanical and chemical removal. A discussion on the impacts and control efforts for Sahara mustard, and other invasive species, is provided in Section 7.11.1 *Invasive Species*.

Erosion resulting from road construction and improvement and the use of unauthorized off-road vehicles has occurred in isolated areas. Fugitive dust from erosion has the potential to disrupt training due to reduced visibility, fouling of mechanical and electrical systems, and effects on the health of personnel training at the BMGR.

2.4.2 Land Use

Although the BMGR is technically a withdrawn land area, from the perspective of supporting military operations, the range is composed of both lands and overlying restricted airspace reserved for military purposes (Figures 2.9–2.11). The restricted airspace dimensions of the BMGR remain unchanged from those that were in effect following the implementation of the MLWA of 1999. The four restricted airspace areas overlying the range—R-2301W, R-2301E, R-2304, and R-2305—are designated by the Federal Aviation Administration to support the military training missions of the range. The BMGR currently supports a wide diversity of tactical aviation training activities as well as selected ground training and training support operations.

Air and land space that directly support regular military training activities serves principally to provide

- the surface space needed to adequately disburse activities so that realistic training can regularly occur either as independent but simultaneous events or as large-scale, combined

action events;

- the flexibility to host irregularly scheduled training or testing activities, (e.g., air-to-air missile shoots or long-range air-to-ground weapons deliveries) that require restricted air and land space configurations that cannot be accommodated by standard weapons ranges or other activity areas; and
- buffers that permit multiple independent training events to safely occur simultaneously on a non-interference basis and that also protect public safety.

Although substantial changes have occurred over the decades in aircraft, weapons, and warfighting tactics, the corresponding development and improvements in weapons ranges and other training sites has led to only a modest and usually incremental expansion in the footprint of surface use needed to directly support training activities. The basic configurations of the weapons ranges established from 1950 through the 1980s, coupled with necessary upgrades and routine maintenance, have enabled many of these facilities to provide long-standing and sustainable training support.

The aggregate footprint of surface disturbance, after several decades of range use that affects the ground surface, surface hydrology, and or vegetative communities in more than a negligible way, is approximately 13%. The greatest disturbance occurs within 1000 feet of a target. Disturbance includes impacts from munitions, rockets, and flares, large and small bomb craters, vehicle tracks and bomb drags from EOD clearances to remove UXO, and construction and maintenance activities associated with targets and roads.

Therefore, the primary focus of ecosystem and biodiversity management at BMGR has been landscape-level protection and conservation rather than manipulation or restoration. Similarly, the primary focus of protected species management has been the protection and conservation of existing natural habitats. The current endangered or threatened status of protected species at the BMGR has resulted largely from historical and ongoing losses of off-range habitat, disease, adverse climatic trends, and other negative effects of non-military activities. Although military activities pose some risks to certain species, these potential effects are comprehensively mitigated, and military use of the range has not been found to jeopardize any protected species. In fact, effects of substantial habitat protection at BMGR have contributed markedly to the continued existence and recovery potential of the pronghorn and continued conservation of the FTHL. Additional information on the Sonoran pronghorn, FTHL, and other protected or sensitive species, is provided in Section 7.4 *Management of Threatened and Endangered Species*.

BMGR East

The BMGR East land area is currently divided into eight aviation subranges for safely supporting multiple and simultaneous training or other operations. The BMGR East also includes Gila Bend AFAF, Stoval Auxiliary AUX, and AUX-6 to support training in forward area airfield operations, observation points, and other facilities.

In 2010, proposed range enhancements were analyzed in the *Final Environmental Impact Statement for Proposed BMGR East Range Enhancements* (USAF 2010) and approved for implementation in a Record of Decision (ROD). Since implementation of the 2012 BMGR INRMP, the following

enhancements either have been completed or may occur during the five-year planning period covered by the INRMP (2018–2023).

- Convert Range 3 into a helicopter gunnery range to better support the specialized training needs of rotary-wing users. Construction of the range has been completed and use of the area for gunnery training has begun. Improvements to the original design are to be made as part of ongoing maintenance.
- Construct a new taxiway and a new air traffic control tower at Gila Bend AFAF. These improvements would enhance the safety of operations, eliminate the need for waivers of certain airfield criteria, and enhance the capability of Gila Bend AFAF as a divert airfield for aircraft experiencing in-flight emergencies while operating from the BMGR East. The new control tower would meet the minimally acceptable visual surveillance or depth-perception standards specified by the Unified Facilities Criteria for military airfields. This action was selected for implementation in a ROD, but funding for the project is not yet available.
- Pave approximately 7 miles of an existing graded road between the main tower and Range Munitions Consolidation Points (also referred to as the Water Well) at Range 1 to eliminate dust generated by the ongoing heavy use of the existing road; decrease road maintenance requirements by providing a cost-effective, durable, and long-lasting maintenance solution; and reduce the vehicle maintenance burden resulting from disproportionate wear and tear on USAF vehicles that frequently travel on this road. Paving this road is subject to the availability of funds; expected completion date is 2020 or sooner.
- Develop a moving vehicle target in North Tactical Range (NTAC) to provide aircrews with realistic training in attacking mobile ground targets. A moving target operating on an existing road on the ETAC has been in use (for strafing only) since 2010; however, a more robust moving target complex to support bomb and rocket employment is needed. A location on NTAC was selected in a ROD. This action has not been implemented.

The remaining "enhancements" described in the 2010 Environmental Impact Statement (EIS) are designed to improve operations but do not involve construction on the range.

- Lower the operational floor of R-2301E restricted airspace over the Cabeza Prieta NWR to enable fixed-wing aircraft aircrews to perform realistic low-level attacks on targets located in the South Tactical Range (STAC) and realistic low-level air-to-air intercepts in the air-to-air combat tactics Range. Currently, overflights of the refuge are restricted to altitudes of 1,500 feet AGL or higher, except within approved corridors, under the terms of a 1994 MOU between the DoD and DOI. The 2010 EIS assessed proposals to lower the overflight floor to 500 feet AGL to support low-level attack and intercept training that would provide combat conditions that aircrews may encounter in real-world scenarios. Implementation of this approved action will not occur until the MOU is renegotiated.
- Authorize additional ground-based training for combat search and rescue teams, special operation teams, USMC units, and potentially other small squads of troops that involve clandestine insertions and extractions from helicopters or vehicles, cross-country land navigation, and other activities while traveling in stealth on foot. The 2010 EIS assessed proposals to expand the opportunities for this type of training. Helicopter insertions and

extractions and vehicle movements associated with this training would be restricted to existing helicopter landing zones and roads. This proposal has been implemented.

- Establish streamlined procedures to facilitate environmental reviews and approvals for reconfiguring or otherwise updating tactical range targets on a timely basis to provide training that reflects the combat conditions that U.S. warfighters will encounter when meeting real world threats. This proposal has been implemented.

BMGR West

MCAS Yuma organizes its air and ground combat forces into Marine Air Ground Task Forces, which form the fundamental cornerstones of modern USMC combat doctrine. These forces are scalable and tailored for specific missions (e.g., humanitarian assistance, emergency response, peacekeeping, specific regional threat, and major war abroad) that integrate air and ground assets to accomplish the assigned mission. With the exceptions of the R-2301W restricted airspace being divided into four aviation subranges, all of the listed training facilities and features are ground-based.

The USN approved development of the Auxiliary Landing Field (ALF) complex to support Marine Corps F-35B training for the West Coast basing of the F-35B aircraft (USFWS 2010a). Construction was completed in 2015. The F-35 will replace the AV-8B aircraft in USMC squadrons based at MCAS Yuma. The current military features, facilities, and uses are shown in Figure 2.11 and detailed in Table 2-16 with notations as to whether they were constructed after 2012

2.4.2.1 The BMGR Road System and Public Access

Continued surveys and monitoring of the road system have prompted Luke AFB and MCAS Yuma to propose changing the road classifications and adding recently created roads to support military training, resource management, and law enforcement purposes. The current status of the BMGR road system and public access opportunities are addressed in the following sections.

BMGR East

The 2018 road system includes maintained roads through active target complexes, but it does not include all of the vehicle routes that are used within the complexes to construct and maintain individual targets or those used for Explosive Ordinance Disposal (EOD) clearance activities. The surface areas within target complexes affected by construction, maintenance, and EOD clearance vehicles are located in open areas that are already heavily disturbed by bombing and strafing. Vehicle operations associated with these activities contribute to the ground disturbance. Occasionally, the USAF may need to reuse a closed road when it is the only means of accessing a specific location for certain activities, such as conducting a Native American group visit to a remote cultural resource site or transporting equipment to an isolated location. The closed road would be used for such an occasion but would not be otherwise mapped, marked, or signed for other government agency use, as is done with roads classified for regular administrative use. The road would remain classified as closed and would be treated as closed for all routine government uses. When the need to reuse a closed road is identified, the USAF would evaluate the proposed use for compliance with environmental laws (e.g., to verify that no species newly listed as either threatened or endangered, or proposed for listing, under the ESA are likely to occur in the area). Closed roads that have been

reclassified as recovered former roads would require careful assessment of the potential effects of the proposed reuse on their recovered status before new use of these former routes could be approved.

As indicated in Table 2-13, the active road system, as recorded in 2018, includes a total of 773 miles of roads, 162 miles of which are designated as available to provide public access. Because extensive areas of the BMGR East continue to be used on a regular basis for hazardous military activities, general public access is limited. Public access to Management Unit 6 (which includes what is known as Area B) is subject to temporary closures as needed for military purposes. Areas currently open to the public also may be closed to protect vulnerable natural or cultural resources from damage.

As outlined in Table 2-13, additional surveys and monitoring of roads have led to the changes in miles of roads as follows (Figure 2.7).

- Roads open for administrative use only in hazard/security areas has increased by six miles. This difference is from the construction of new roads to accommodate the addition of numerous Air Force facilities across the range.
- Miles of roads classified for public use inside military hazard/security areas has increased by 7 miles, from 5 to 12. This increase is due to a more accurate measurement of the roads.
- Miles of roads classified for administrative use only outside of hazard/security areas has increased from 11 to 23 miles. The increase is due to the addition of a couple of new roads.
- Miles of roads classified for public use outside of hazard/security areas has decreased by 8 miles from 170 to 162 miles. The decrease is due to a change in status of a section of road leading to Range 2 and road closures due to habitat restoration.

Table 2-13: BMGR East designated road system 2012 and 2018.

Road Category	2012	2018
Miles of roads classified for administrative use only inside military hazard/security areas that exclude public access.	570	576
Miles of roads classified for administrative or public use inside military hazard/security areas	5	12
Miles of roads classified for administrative use only outside of restricted military hazard/security areas	11	23
Miles of roads classified for public use outside of restricted military hazard/security areas but subject to temporary closure for military purposes	170	162
Total Miles of Road	**756**	**773**

BMGR West

The designated road system continues to function as documented in the 2012 INRMP, with a few minor exceptions. The 2012 INRMP reported three road designations: miles of administrative use only roads inside military hazard/security areas, miles of administrative use only roads outside of military hazard/security areas, and miles of roads classified for administrative or public use outside

of restricted military hazard/security areas. For 2018, the road designation system was simplified to include only two categories: miles of roads classified for administrative use only and miles of roads classified for public and administrative use. The difference in miles of administrative use only roads is due to more accurate surveys of the roads. No new roads have been added to the BMGR West during the 2012–2018 timeframe.

The area available for general public access continues to include about 75 percent of the BMGR West. All or portions of the public use area are subject to occasional temporary closures to support military activities that present safety hazards and/or have security requirements.

The active road system includes a total of 636 miles of active roads, including 427 miles of public access roads (Table 2-14 and Figure 2.8).

Table 2-14: BMGR West Designated Road System 2012 and 2018.

Road Category	2012	2018
Miles of roads classified for administrative use only	195	209
Miles of roads classified for public and administrative use	427	427
Total Miles of Road	**622**	**636**

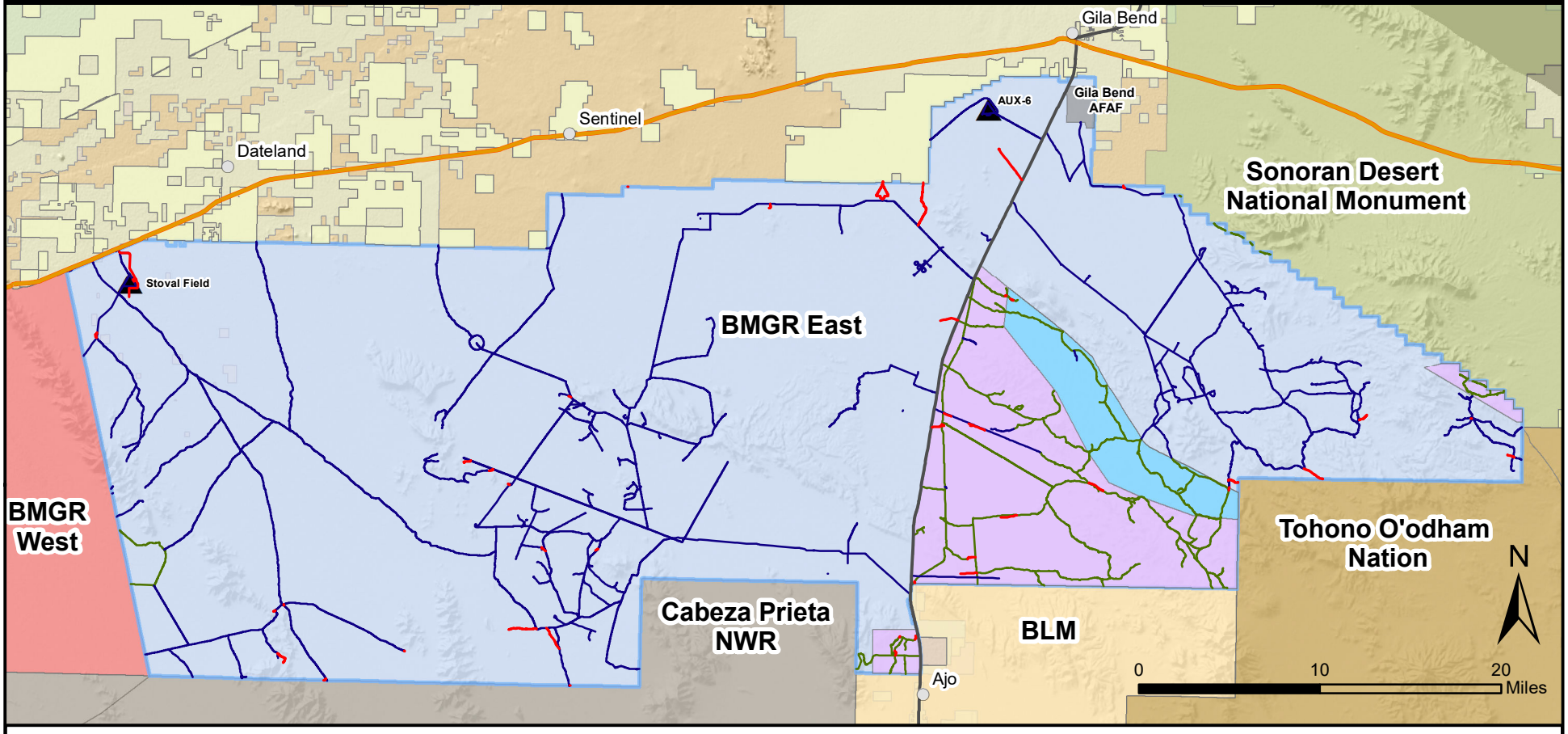
As outlined in Table 2-14, additional surveys and monitoring of roads have led to the changes in miles of roads as follows.

- Miles of road classified for administrative use only has changed from 195 miles to 209 miles. The change in road mileage is due to more accurate road surveys.

Figure 2.7: BMGR East Travel Management

Barry M. Goldwater Range (BMGR)

2018-2023 Integrated Natural Resource Management Plan (INRMP)



Legend

- Cities
- Interstate 8
- State Route 85
- BMGR East
- BMGR West
- Gila Bend AFAF
- Cabeza Prieta NWR
- Sonoran Desert NM
- Tohono O'odham Nation
- BLM
- State Trust Land
- Hazard Area - Access is only granted when range is closed. Valid permit required.
- BMGR East Public Access

BMGR East Designated Road System

- Road for Administrative (Government) Use Only
- Closed Roads
- Road Open for Public and Administrative Use
- Auxiliary Airfield (AUX)

World Geodetic System 1984
(WGS84) Projection
Zone 12 N
GCS_WGS_1984

Base data from ESRI StreetMap
Hillshade derived from USGS NED

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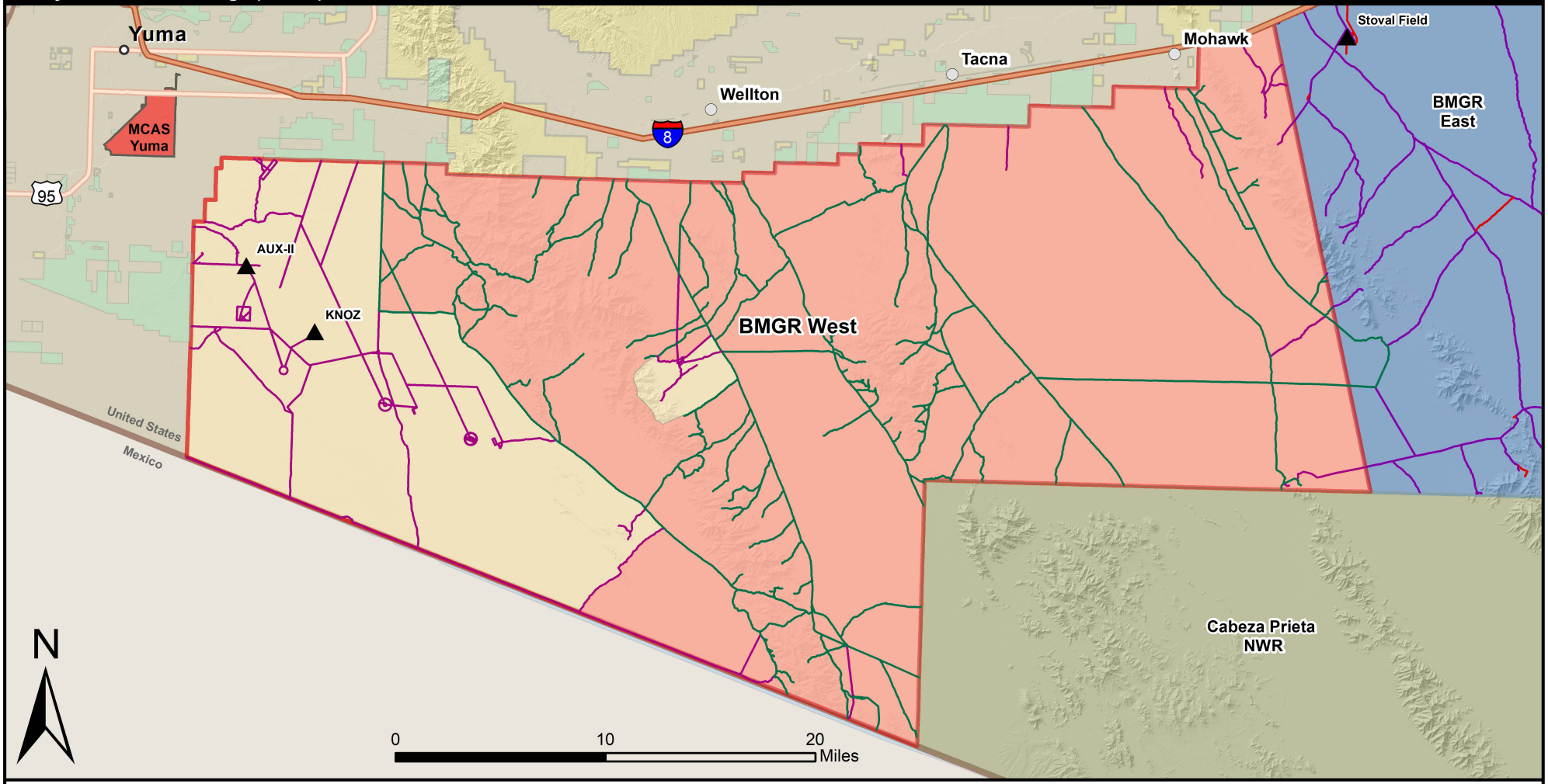
Figure 2.8: BMGR West Travel Management

Barry M. Goldwater Range (BMGR)

2018-2023 Integrated Natural Resource Management Plan (INRMP)



Legend

- City/Town
- Interstate 8
- Highways
- BMGR West
- BMGR East
- MCAS Yuma
- Cabeza Prieta NWR
- BLM
- State Trust Land
- BMGR West Public Access
- Auxiliary Airfield (AUX)

BMGR West Designated Road System

- Road for Administrative (Government) Use Only
- Road for Public and Administrative Use

World Geodetic System 1984
(WGS84) Projection
Zone 11 N
GCS_WGS_1984

Base data from ESRI StreetMap
Hillshade derived from USGS NED

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Table 2-15: BMGR East current military training facilities, features, and use.

Area/Activity	Description of Current Training Feature, Facility, and Military Use	Status Since 2012 INRMP
BMGR East Land Base	BMGR East, which represents 60 percent of the total BMGR acreage, is divided into 8 subranges (numbered and tactical ranges, and the air-to-air range—as described below) that may be scheduled separately to support multiple missions or scheduled together for larger exercises and events.	Unchanged
Restricted Airspace	The areas defined by R-2301E, R-2304, R-2305 lateral boundaries, the altitude floors and ceiling remain unchanged since before 1960. They are not affected by the land withdrawal. R-2301E overlies most of the BMGR East land area, including Stoval AUX, two tactical ranges (NTAC and STAC), three of the four numbered ranges (1, 2, and 4), and the Air-to-Air range. The area extends from the surface to 80,000 feet AMSL. R-2304 overlies ETAC, part of Area B, which is open to the public by permit, and a small portion of the Tohono O'odham Nation. R-2305 overlies Range 3 and its facilities and extends south over a portion of Area B. The vertical limits of both R-2304 and R-2305 are surface to 24,000 feet AMSL.	Unchanged
Numbered Ranges	Four numbered ranges capable of supporting Class A (scored) operations support primary instruction in air-to-ground delivery of bombs, rockets, and gunnery (inert/training ordnance only). The airspace associated with these ranges may be scheduled concurrently with adjacent tactical ranges as needed. Facilities on and use of these subranges remain almost entirely unchanged since well before the 2012 INRMP update. The single exception was conversion of the left side of Range 3 to a helicopter gunnery range. Construction of this facility began in 2012; it has since been completed and is in use.	Changed
Tactical Ranges	Three tactical ranges (NTAC, STAC, and ETAC) support aircrew training in gunnery, bomb, rocket, and missile employment. Targets simulate tactical features such as airfields, railroad yards, missile emplacements, truck convoys, urban areas, and enemy compounds. Threat simulators may be included in training scenarios to better reflect real-world conditions. Only practice ordnance may be employed on most targets; high-explosive ordnance may be used only on six targets specifically designated for this purpose. The tactical ranges continue to be used on a daily basis for ordnance delivery training. A remotely operated vehicle target operates on an existing road in ETAC and is used for strafing only.	Unchanged

Table 2-15: BMGR East current military training facilities, features, and use.

Area/Activity	Description of Current Training Feature, Facility, and Military Use	Status Since 2012 INRMP
Air-to-Air Range	A portion of this range may be used for air-to-air gunnery and missile firing; however, these operations are scheduled infrequently. This area is used daily for aerial combat and maneuvering training with no ordnance expenditure.	Unchanged
Range Munitions Consolidation Points (RMCPs)	RMCPs 1, 2, 3, and 4 continue to serve as range EOD and maintenance support areas. Expended munitions, munitions scrap, and target debris that is safe for handling is cleared from the three tactical and four manned ranges and transported to the RMCPs for demilitarization and decontamination processing before being released for off-range recycling or disposal. The RMCPs are also used as staging locations for target construction, maintenance, and replacement operations. The use and configuration of these areas are unchanged since the 2012 update.	Unchanged
EOD Training Range	The EOD Training Range continues to be used for instructing EOD technicians to perform safe detonations of expended but unexploded ordnance. Detonation of high-explosive charges weighing up to 2,000 pounds net explosive weight is authorized in this area.	Unchanged
Small Arms Range	Since 2012, minor improvements and repairs to the Small Arms Range have been completed. The range continues to be used almost daily for small arms training by the BP and, occasionally, by USAF Security Police.	Changed
Gila Bend AFAF	Gila Bend AFAF continues to serve as the operational support center for the BMGR East. It includes an 8,500-foot runway, six helipads, and other airfield facilities, as well as offices, workshops, storage, lodging, and other spaces. No active duty personnel or aircraft are permanently based at Gila Bend AFAF. Construction of a taxiway for the runway and a new air traffic control tower were assessed in an EIS and selected in a ROD for implementation; however, funds to complete these projects are not yet available. Ongoing maintenance and improvement of facilities at Gila Bend AFAF are routinely conducted.	Unchanged

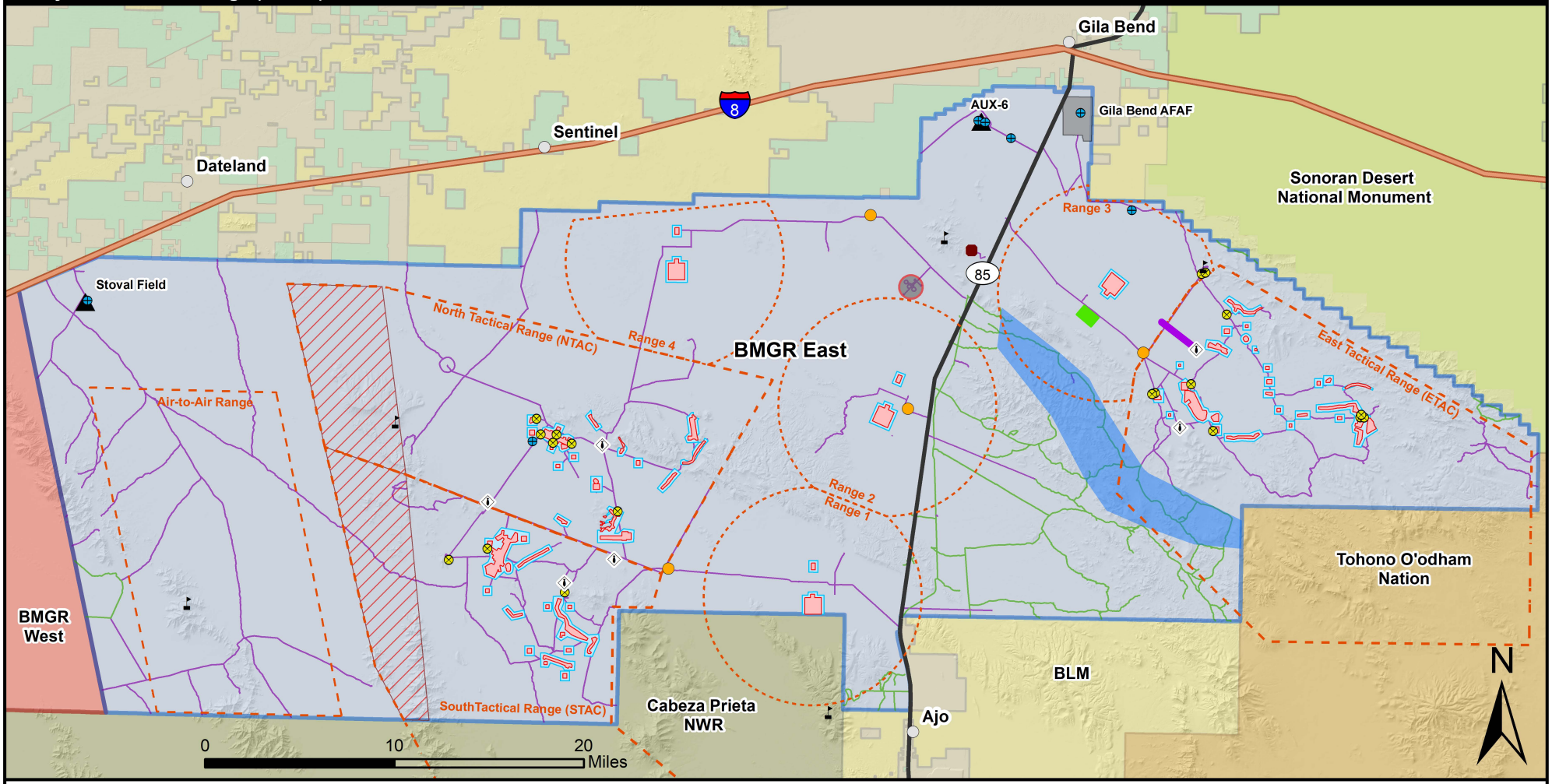
Table 2-15: BMGR East current military training facilities, features, and use.

Area/Activity	Description of Current Training Feature, Facility, and Military Use	Status Since 2012 INRMP
Assault Landing Zones (Auxiliary Airfields)	Auxiliary Airfield (AUX) 6 and Stoval airfields are World War II era triangular airfields used for certain limited training activities. AUX-6 is regularly used for C-130 and helicopter operations by USAF, USMC, and ARNG units. Since 2012, upgrades to runway surfaces have improved the safety of these operations. Stoval airfield, on the far west side of the BMGR East, is used by USMC units, primarily during the twice-yearly weapons and tactics instructor courses. Landing zone and drop zone operations are conducted at both these locations. AUX-11 is no longer used as an airfield, but serves as a site for exercise-specific communications operations.	Unchanged
Sand and Gravel Excavation and Stockpile Areas	Excavation of sand and gravel from ten wash locations in the BMGR East and stockpiling of these materials at five sites for later on-range use is approved but not yet implemented; a permit from Maricopa County is required. The sand and gravel may be used in target construction or road repairs as needed.	Unchanged
EOD Clearance	EOD clearances occur annually, every two years, and every 10 years. Annual clearances entail removing expended ordnance and target debris on the surface within 50 feet of roads and target access ways and in the vicinity of targets to maintain safe work areas for maintenance, reconstruction, or replacement of targets. Every two years, ordnance and target debris on the surface is cleared inside a 300-foot radius around each inert/practice ordnance target and inside a 500-foot radius around each live ordnance target. Every ten years, ordnance and target debris on the surface is cleared inside a 1,000-foot radius around each inert/practice and live ordnance target. No EOD clearances are conducted within the Air-to-Air subrange.	Unchanged
Air Combat Training Systems	Air Combat Training Systems provide a variety of technologically advanced equipment and support capabilities, including the Range Operations Coordination Center (Snakeye), Air Combat Maneuvering Instrumentation, scoring and feedback systems, and simulated ground-to-air threats. Electronic equipment is continually upgraded; some remote equipment locations, both on and off range, are no longer needed.	Unchanged

Figure 2.9: Current Military Use at BMGR East

Barry M. Goldwater Range (BMGR)

2018-2023 Integrated Natural Resource Management Plan (INRMP)



Legend

- City/Town
- Interstate 8
- State Route 85
- BMGR East
- BMGR West
- Gila Bend AFAF
- Cabeza Prieta NWR
- Sonoran Desert NM
- Tohono O'odham Nation
- BLM
- State Trust Land
- Air Combat Maneuvering System
- Air Force Small Arms Range
- Range Munitions Consolidation Point (RMCP)
- Parachute Drop Zone
- Auxiliary Airfield (AUX)
- Helicopter Landing Zone
- Moving Vehicle Target
- Smokey SAMs Launch Site
- EOD Training Range
- Numbered Range Boundary (air)
- Tactical Range Boundary (air)
- Helicopter Gunnery Range
- Moving Vehicle Target
- EOD 2-Year Clearance Area
- EOD 10-Year Clearance Area
- Hazard Area - Access is only granted when range is closed. Valid permit required.
- Hazard Area - NTAC and STAC

BMGR East Roads

- Road for Administrative (Government) Use Only
- Road Open for Public and Administrative Use

World Geodetic System 1984
(WGS84) Projection
Zone 12 N
GCS_WGS_1984

Base data from ESRI StreetMap
Hillshade derived from USGS NED

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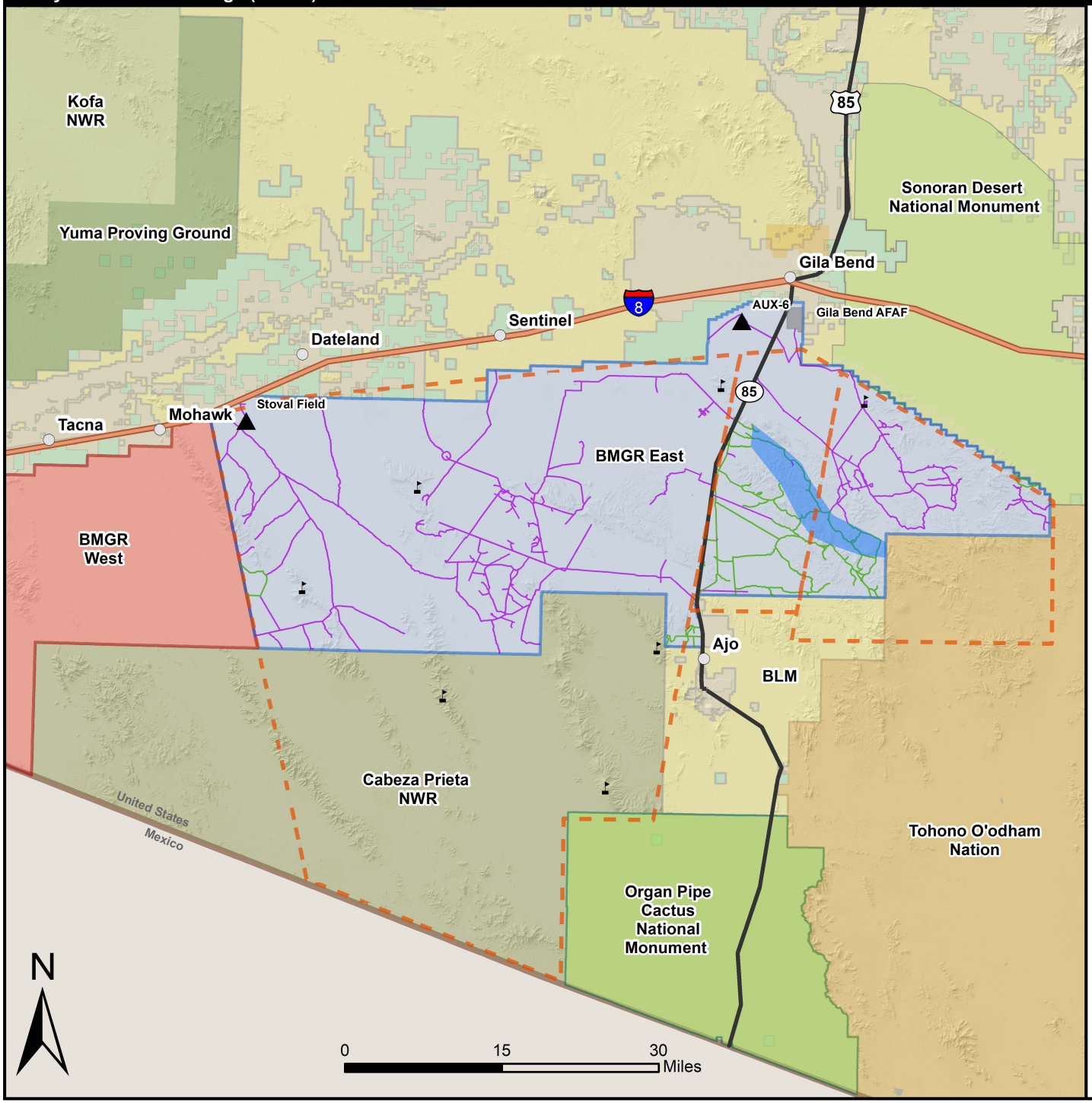
Figure 2.10: Restricted Airspace at BMGR East

Barry M. Goldwater Range (BMGR)

2018-2023 Integrated Natural Resource Management Plan (INRMP)



Legend

- City/Town
- Interstate 8
- State Route 85
- BMGR East
- BMGR West
- Gila Bend AFAF
- Yuma Proving Ground
- Cabeza Prieta NWR
- Kofa NWR
- Sonoran Desert NM
- Tohono O'odham Nation
- Organ Pipe Cactus NM
- BLM
- State Trust Land
- Air Combat Maneuvering System
- Auxiliary Airfield
- Restricted
- Hazard Area - Access is only granted when range is closed. Valid permit required.

BMGR East Roads

- Road for Administrative (Government) Use Only
- Road Open for Public and Administrative Use

World Geodetic System 1984
(WGS84) Projection
Zone 12 N
GCS_WGS_1984

Base data from ESRI StreetMap
Hillshade derived from USGS NED

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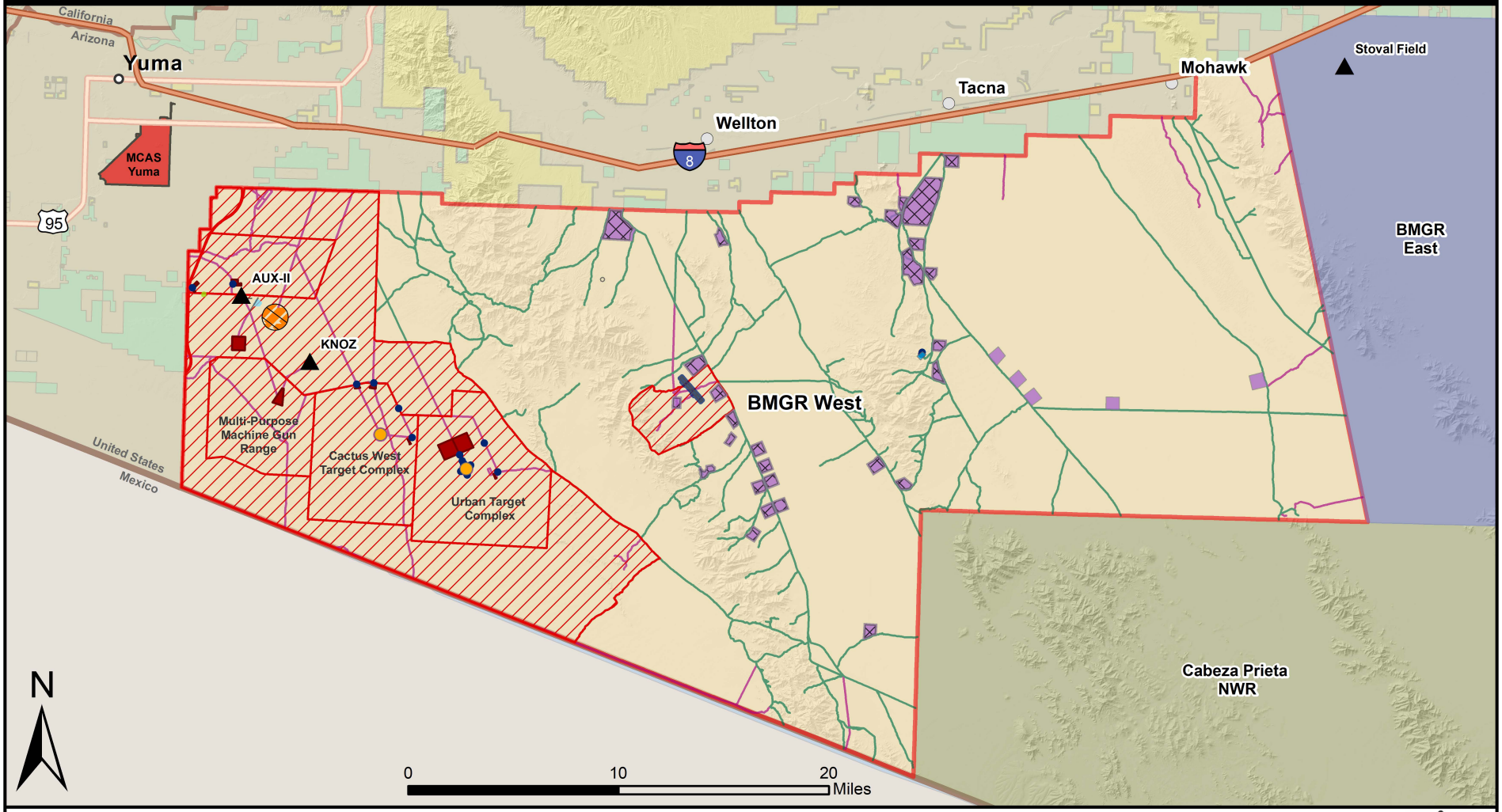
Figure 2.11: Current Military Use at BMGR West

Barry M. Goldwater Range (BMGR)

2018-2023 Integrated Natural Resource Management Plan (INRMP)



Legend

- Interstate 8
- Highways
- City/Town
- MCAS Yuma
- BMGR East
- BMGR West
- Cabeza Prieta NWR
- BLM
- State Trust Land

BMGR West MilitaryTraining

- Aerial Bombing Range
- AUX II Bivouac Site
- Gas Chamber for Personal Equipment Operations
- Ground Support Area
- Urban Infantry Training Range
- Auxiliary Airfield (AUX)
- Landing Zone Area
- Impact Area
- Observation Position Point
- Parachute Drop Zone
- Training Range
- Restricted Access/Hazard Areas
- BMGR West Designated Admin Use Only Road
- BMGR West Designated Public and Admin Use Road

World Geodetic System 1984
(WGS84) Projection
Zone 11 N
GCS_WGS_1984

Base data from ESRI StreetMap
Hillshade derived from USGS NED

Created By:
Center for Environmental Management
MILITARY LANDS
Colorado State University

Table 2-16: BMGR West current military training facilities, features, and use.

Range Feature or Facility	Description of Current Training Feature, Facility and Military Use	Status Since 2012 INRMP
Surface Area and Airspace		
BMGR West Surface Area	BMGR West represents approximately 40 percent of the total BMGR acreage. Boundary and land withdrawal areas are as established by the MLWA of 1999.	Unchanged
Restricted Airspace	R-2301W lateral boundaries, altitude floor (ground surface), and altitude ceiling (80,000 ft. AMSL) remain unchanged since 1960.	Unchanged
Airspace Subranges	Four airspace subranges, including TACTS-Hi, TACTS-Low, Cactus West, and AUX-II, are allocated to one or more subranges or are aggregated into larger units as needed to support training.	Unchanged
Aviation Training Ranges and Facilities		
AUX-II	AUX-II provides an assault landing zone airstrip for training aircrews of C-130 aircraft to operate in and out of a primitive landing zone in a forward area. AUX-II also continues to be used as a staging area or forward arming and refueling point for helicopter operations.	Unchanged
F-35B ALF	Construction of the F-35B ALF (known as KNOZ) was completed in 2015. The ALF includes three simulated landing helicopter assault decks, flight control towers, aircraft maintenance shelter, refueling apron, and a fire and rescue shelter.	Changed
Cactus West Target Complex	Cactus West Target Complex includes (1) a bull's-eye target located inside a 1,500-foot radius bladed circle, and (2) two-berm and panel targets for strafing practice. Ordnance deliveries are restricted to inert and practice munitions. As described later in this table, the Cactus West Target receives impacts from the Convoy Security Operations Course 2 Range and as a Live Ordnance and Drop Tank Jettison Area.	Unchanged
Urban Target Complex (UTC)	The UTC provides a simulated urban setting with streets, 240 buildings, multiple targets, and vehicles for training aircrews in precision air-to-ground attack in densely developed and populated areas. The UTC Range is located inside the fenced area. The complex also has a moving land target, which consists of a remotely controlled vehicle that pulls a target sled on an oval track.	Unchanged

Table 2-16: BMGR West current military training facilities, features, and use.

Range Feature or Facility	Description of Current Training Feature, Facility and Military Use	Status Since 2012 INRMP
Instrumentation	A portion of the TACTS Range is instrumented to support air-to-air and air-to-ground combat training. The electronic architecture is composed of 27 fixed-position and 17 mobile-positions that can track, record, and replay the simultaneous actions of 36 aircraft and scoring weapon use. The air-to-ground weapons delivery component is supported by 112 individual passive tactical target sites situated in 11 complexes that simulate airfield installations, power stations, fuel storage facilities, buildings, railway facilities, anti-aircraft missile and gun positions, and military vehicles. No munitions are fired or otherwise released on this electronically scored range.	Unchanged
Air-Ground Training Facilities		
Ground Support Areas	Thirty-three undeveloped ground support areas allow units to participate in off-road training exercises. Most ground troop deployments are coordinated with aviation training exercises to enhance the realism of air-ground training evolution for both elements.	Unchanged
Parachute Drop Zones (DZ)	Twenty-one parachute tactical DZs are currently designated. The AUX-II DZ is located within a previously disturbed, inactive bull's-eye bombing target. The DZ immediately to the East of AUX-II is the only DZ approved for parachute cargo drops, which require retrieval by an off-road combat fork lift. The other 10 DZs are located within ground support areas to minimize off-road driving for retrievals.	Unchanged
Ground Combat Training Ranges		
Rifle and Pistol Ranges	The Rifle and Pistol Ranges are used to train and qualify personnel in the use of small arms.	Unchanged
Small Arms Live-Fire Maneuver Range (Range 2)	The Small Arms Live-Fire Maneuver Range is located in an unused sand and gravel borrow pit and serves as a close combat maneuvering range for training small teams or individuals in the tactical use of infantry small arms.	Unchanged

Table 2-16: BMGR West current military training facilities, features, and use.

Range Feature or Facility	Description of Current Training Feature, Facility and Military Use	Status Since 2012 INRMP
Multi-Purpose Machine Gun Range (Panel Stager)	The Multi-Purpose Machine Gun Range is located at the inactive air-to-ground bombing target at Panel Stager Range 2. Ground-to-ground machine gun fire of .50 caliber and smaller is directed from guns mounted on vehicles traveling on existing access roads at target sets located in the retired bombing impact area.	Unchanged
Convoy Security Operations Courses 1 and 2 and Murrayville (East and West)	Four Convoy Security Operations Courses are designed to train troops assigned to protect vehicle convoys in combat theaters and how to recognize, counter, and defeat threats from hostile forces. Static and pop-up targets that simulate threats are located in ambush scenarios along the access roads and run-in line. These are located along the existing access roads in the vicinities of the Cactus West Target Complex, UTC and along the run-in line to the UTC. Ground-to-ground machine gun fire of .50 caliber and smaller may be directed from guns mounted on vehicles or run-in-line at target sets designed to simulate ambush attacks by hostile forces. The direction of fire from the access roads in the vicinity of the Cactus West complex is generally to the south such that the Cactus West target impact area is affected. The direction of fire from the run-in-line is generally at target sets to the east or west such that the existing target impact areas at the UTC also serve as an impact area.	Unchanged
Combat Village	Combat Village simulates a small building complex adjacent to a railroad. This facility is used as an electronically scored target and for training small units in infantry tactics involving reconnaissance, assaults, or defense. Only blank small arms munitions and a special effects small arms marking system are authorized for use at this infantry tactics training site.	Unchanged
Hazard Areas	Five hazard areas, four to the west and one to the east of the Gila and Tinajas Altas mountains, support use of small arms and/or aircraft lasers in training operations. Surface entry to hazard areas is closed to nonparticipating personnel when hazardous activities are scheduled.	Unchanged
Support Areas		
Cannon Air Defense Complex	The Cannon Air Defense Complex provides administrative, maintenance, and training areas for a Marine Air Control Squadron. The complex is a permanent built-up facility of about 192 acres.	Unchanged

Table 2-16: BMGR West current military training facilities, features, and use.

Range Feature or Facility	Description of Current Training Feature, Facility and Military Use	Status Since 2012 INRMP
AUX-II Field Ammunition Supply Point	The Field Ammunition Supply Point, located about 1,500 feet northwest of AUX-II, provides temporary secure storage for munitions used by ground units during field exercises, primarily during semi-annual weapons and tactics instructor courses.	Unchanged
Munitions Treatment Range	The Munitions Treatment Range is used to train personnel in the use of demolition explosives and unexploded ordnance.	Unchanged
Live Ordnance and Drop Tank Jettison Area	The Cactus West Target bull's-eye is used as a Live Ordnance and Drop Tank Jettison Area for aircraft experiencing difficulties that warrant a precautionary jettisoning of external stores prior to recovery at MCAS Yuma. Panel Stager Range 2 is presently used as the impact area for the Multi-Purpose Machine Gun Range.	Unchanged

2.4.3 Current Major Mission Impacts on Natural Resources

2.4.3.1 Impacts from Invasive Species

The spread of invasive plant species impacts the range by altering native vegetation communities and modifying the resiliency of the landscape and its ability to adapt to future stressors. These impacts may also affect future military training missions and degrade critical wildlife habitat. Invasive plants displace native vegetation through direct competition and by altering the natural Sonoran Desert fire regime. The spread of invasive species, such as Sahara mustard and buffelgrass (*Pennisetum ciliare*), leads to increasing fuel loads and altered fuel continuities that can endanger fire-intolerant native species. Non-native grasses and forbs can form monocultures across the landscape that not only altering vegetation composition, they can promote increased fire size, frequency, and intensity (Geiger and McPherson 2005). Moreover, many invasive species tend to be the first species to recover post-fire, thus increasing their density and coverage. Combined, all these factors result in positive feedback loop, whereby increasing abundance and density of invasive species leads to increased and more intense fire activity, which in turn favors increased abundance of those species and, subsequently, increasingly frequent and larger fires.

Invasive animals, including trespass livestock, impact native vegetation directly through herbivory, increased soil trampling and degradation, and indirectly by dispersing invasive plant seeds into new areas. In addition to impacting native vegetation communities, trespass livestock also compete with wildlife for available forage and water resources. Impacts to the military training mission caused by

invasive livestock include the delay, interruption, and cancellation of live-fire training activities; an increased risk of livestock/vehicle collisions; and fire fueled by the expansion of invasive weeds.

A more detailed list of impacts as well as current and future management objectives for combating invasive plant and animal species is included in Section 7.9, *Wildland Fire Management* and Section 7.11, *Integrated Pest Management Program*.

2.4.3.2 Remediation Activities

Since the 2012 INRMP update, there was an investigation of and remediation activities at several former munitions treatment and disposal areas at AUX-6 at BMGR East. Ammunition disposal probably continued there until the early 1970s. There are three Solid Waste Management Units (SWMU) that underwent remediation:

- SWMU 2-1 is the site of a former underground munitions-burning furnace, associated fuel tank, and pipeline. It is located within the infield portion of AUX-6 bounded by the three runways. Munitions residue was removed from the furnace after it had been shut down and allowed to cool.
- SWMU 2-2, located in the southeast portion of AUX-6, was reportedly used for thermal treatment of munitions, including pyrotechnics, cartridge- actuated devices, and 20 mm ammunition.
- SWMU 2-3, also known as the Northwest Open Burn/Open Detonation Area, is located in the northwest portion of AUX-6 near the northernmost apex of the triangle formed by the three runways. Combustible dunnage (largely wood items) and diesel accelerant were used to ignite/burn munitions placed in a trench; resulting explosions scattered shrapnel around the trenches. Open detonation of munitions entailed placing a high-explosive donor on each item followed by detonation; the most commonly used donor charge was C-4 plastic explosive composed of chlorotrimethylene-trinitramine and a plasticizer.

The SWMUs at AUX-6 are subject to the closure requirements of 40 CFR 264 (*Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities*) Subpart G (Closure and Post-Closure). A Hazardous Waste Management Area Post-Closure Permit under the Resource Conservation and Recovery Act (42 U.S.C. 6901 et seq.) has been obtained by Luke AFB from ADEQ for Unit 8 of the Munitions Treatment Range in June 2006. A condition of the Post-Closure Permit required completion of a Resource Conservation and Recovery Act Facility Investigation to determine whether munitions constituent releases require additional corrective measures to formally close SWMUs 2-1 and 2-3. All fieldwork has been completed and a final report is due early 2018. Details of what was uncovered by the investigations and subsequent remediation will be provided in the BMGR INRMP Public Report on Military Use, Environmental Conditions, Resource Management Activity, and Public Access Involvement 2018–2023.

2.4.4 Potential Future Mission Impacts on Natural Resources

To meet the needs of the future, the BMGR must become a fully relevant 5th generation range. The basing of F-35A aircraft at Luke AFB and F-35B at MCAS Yuma will drive short-term and long-term changes. To maximize effectiveness, F-35 operations and training require larger blocks of airspace

for longer periods and more plentiful, sophisticated, and realistic targets and threats. Options to address these needs, which have the potential to affect natural resources, include the expansion of available airspace (requiring either physical expansion of airspace, increased range operating hours, or both), as well as acquisition and placement on the range of more realistic targets, perhaps in previously undisturbed areas.

2.4.4.1 Climate Impacts on Mission and Mission Planning

The large expanses of remote, undeveloped land and airspace that are needed to fulfill the mission of the BMGR do not require specific habitat or vegetation types that may be an integral part of mission readiness at other installations. Climate change will have negligible to no effect on the amount of air and land space available. Increased risk of widespread fires (related to increased temperatures, increased winter rains, and invasive grasses) could impact infrastructure such as targets and electronics. Fires and flood damage to roads could reduce required access for maintenance crews, pronghorn monitors, and personnel who maintain infrastructure. In addition, climate change is expected to have secondary effects on the mission.

Future impacts to the mission linked to climate change could include:

- Increases in temperature and wind velocity leading to unsafe environmental conditions for the launch of current and planned weapons and equipment, increased maintenance requirements, requirements for new equipment, and/or decreased launch capacity (DoD 2014)
- Increased dust generation, affecting equipment and visibility (DoD 2014)
- Damage to vital mission infrastructure from increased wind velocities (Sydeman et al. 2014)
- Increased drought potential (Glick et al. 2011)
- An increased regulatory environment due to shifts in species composition and distributions
- Potential loss of future training areas due to erosion and/or changes in vegetation that may be needed in light of a changing geopolitical landscape
- Potential to disrupt the acquisition and transportation of materials required for the maintenance, construction, and storage of the equipment required for these systems (DoD 2014).

2.5 Impacts from Recreation, Illegal Border Traffic and Deterrence Efforts

Ground disturbance is one of the key factors influencing soil stability and erosion. On a broad scale, the exclusion of certain surface-disturbing activities (e.g., mining, grazing, development, etc.) and limiting areas where military surface use occurs minimize ground disturbance and the associated effects. Decisions implemented by the 2007 INRMP established a designated road system; closed the range to off-road driving except for approved military, resource management, and law enforcement purposes; and established vehicle operating rules. Roads have been posted or otherwise restricted to clearly identify those that are (1) open for administrative (i.e., government) and public use, (2) open only for administrative use, or (3) closed to all users. Public access to the range is granted by permit only and all permitted users are provided with current maps that show the roads and areas that are restricted for administrative use and roads that are open for public use.

Although the designation of the BMGR road system has provided an important tool for controlling and managing roads and vehicle use, off-road driving and the proliferation of new unauthorized vehicle routes have continued. This problem has been compounded by vehicle traffic associated with UDAs and illegal drug smugglers crossing the international border from Mexico and traveling cross-country through the Organ Pipe Cactus NM, Cabeza Prieta NWR, BMGR, and/or the Tohono O'odham Nation.

Although completion of the border barrier fence has reduced illegal cross-border vehicle traffic, it has led to an increase in illegal cross-border foot traffic. In response, BP has expanded its patrolling into new areas where illegal vehicles historically did not travel. Attempts to apprehend and rescue UDAs has resulted in a proliferation of new roads and off-road driving in these new areas.

Cross-border illegal foot traffic has also caused an upsurge in humanitarian aid drops (Figure 2.12). Food, water, clothing, and medical supplies are dropped at areas along UDA foot trails by humanitarian groups as well as nefarious groups intending to directly support illegal drug smuggling activities. Regardless of the intent, this practice has led to increased amounts of litter and trash along the UDA trails, which the military is responsible for cleaning up.

Figure 2.12: Humanitarian aid drops result in waste being left in the desert.

Due to increased illegal foot traffic, BP agents have expanded the use of drag roads as they monitor for UDA foot traffic. Dragging these roads repeatedly over time has contributed to the formation of berms along a majority of the drag roads. In certain places, the road beds have receded below natural grade and, in effect, the berms become small dams that impact the surface flow of water from natural cross road drainages found all across the range (Figure 2.13). These small berm dams are causing surface runoff from small to moderate storm events to pond on the upstream sides of the roads. As a result, thick stands of vegetation, often composed of invasive species, develop in response to the increased soil moisture. Additionally, since water flow is effectively cut off from surrounding areas, the natural vegetation community declines for some distance along the drier downstream sides of the roads.

The altered surface flows also can increase erosion and create abrupt vertical drops in the surface (head cuts) and generally lead to an increased need for more regular road maintenance. Additionally, repeatedly dragging roads tends to widen the road surface, increasing the area of disturbance associated with roads across the landscape. Evidence of this has been observed at BMGR West. The AUX-II road has been widened considerably from dragging, diverting runoff, and creating new, potentially problematic drainage channels.

Due to the increase in UDA foot traffic, BP has also expanded its network of rescue beacons since 2007. Rescue beacons are solar powered radio call boxes that allow UDAs or other individuals to

signal for help when they are lost or endangered by exposure or other environmental hazards. The BP periodically smooths out the area around the rescue beacons by dragging them as they monitor for recent foot traffic. These drag areas were originally intended to be minimal in size, but have been steadily enlarged over time.

To reduce changes in surface drainage and soil erosion from road dragging activities the USAF, USMC, and BP have developed the following SOPs.

Figure 2.13: Example of berms found adjacent to drag roads.

- Drag only within the roadbed
- No loading of drag devices with materials to increase drag weight
- Turn-around in designated areas only
- No increase in turn-around area size
- Drags will not be relocated until they are thoroughly cleaned to remove potential invasive species and/or seeds
- Coordination of desired drag before initiating a new one
- BP Wellton and Ajo Stations have adopted supplemental protocols intended to reduce negative impacts of dragging operations on cultural and natural resources

Additional efforts between the USAF, USMC, and BP to reduce the negative impacts from other sources are listed below.

- Barry M. Goldwater Range Executive Council (BEC) meetings between affected agencies are held six times a year to identify substantive issues, conflicts, or other matters for consideration regarding potential impact upon lands or resources in the BMGR region.
- Regional Road Network Books and Global Positioning System (GPS)/Adobe PDF maps have been created to delineate roads allowed for use in support of the CBP mission.
- All law enforcement agencies are required to complete the Range Access and Safety Training Program.
- CBP Air, Sector and Station Chiefs are required to attend the BMGR orientations.
- BMGR East Small Arms Range can be accessed by CBP for training.
- CBP has access to and use of Gila Bend AFAF facilities, airfield, and all-terrain vehicle storage facilities.
- Airspace access agreements for CBP rotor, fixed wing and Unmanned Aircraft Systems.
- Special operation support is provided to facilitate the BMGR East access.
- CBP radios are routed through the Gila Bend Emergency Coordinate Center to enable direct contact between the military and BP.

- BMGR East has standardized protocols for BP range access and road-dragging activities.

Additional factors contributing to soil erosion and ground disturbance stem from the use of OHVs, sand rails, other recreational vehicles, and unauthorized travel off the public road system. Excessive speeds and caravanning continually over the same routes have contributed to road degradation.

Soil compaction, erosion, and damage to native vegetation resulting from off-road driving can modify the distribution and pattern of overland flow during rain events, reducing available soil moisture for vegetation and causing further erosion by reducing soil cohesion (Brooks and Lair 2009). In addition, soil erosion may directly impact military training activities; instances of high wind speeds in areas where heavy soil erosion has occurred can reduce visibility during training activities as well decrease air quality.

Soil erosion and poor air quality may also negatively affect the health of threatened and endangered species, particularly the desert tortoise, which has experienced population decline due to an airborne virus responsible for an upper respiratory tract disease. While qualitative observations of anthropogenic impacts to soil resources have been noted by range management, there has been no quantitative, data-driven study documenting human and natural impacts to range soil resources, hydrology, overland flow, and air quality.

In the past decade, roads and increasing motor traffic have disturbed the naturally formed desert pavement, resulting in substantial watershed erosion. Currently, many roads are intercepting the natural ephemeral washes (Figure 2.8) and serve as man-made drainage channels for the watershed.

Frequent use of motorized vehicles, particularly on steep slopes, has led to many road surfaces becoming severely incised. Incised roads disrupt the natural moisture regimes required to support woody riparian vegetation downstream of the roads that bisect them. As a result, vegetation types in upper and lower watersheds have become distinctly different as woody riparian vegetation disappears from the lower watersheds. The incised roads also have caused head cuts that extend to the upper watersheds.

BMGR East

In an effort to determine the full scope of damage that illegal border crossing and deterrence is having on the landscape, the USAF began a project to monitor drag roads (Figure 2.14). The purpose of the project is to inform management techniques to prevent increases in erosion and changes to surface hydrology. Road elevations and photo documentation of road conditions are recorded annually

Figure 2.14: Measurements being taken using California rod and auto-level.

and will be compared to document changes in elevation and other characteristics of monitored drag roads. Future analysis could consist of vegetation surveys to compare the vegetation composition adjacent to drag roads and non-drag roads and hydrological studies to determine how drag roads affect surface hydrology.

BMGR West

In 2014, the U.S. Geological Survey (USGS) released its final report to quantify disturbances to soils, vegetation, and cultural resources caused by migrant and smuggling traffic, border security, and general recreational vehicle use. The USGS developed an erosion vulnerability model to identify areas prone to soil erosion from these activities by (1) mapping vehicle disturbances, (2) measuring soil compaction, and (3) using GIS and remote sensing to model soil erosion based on factors from the Universal Soil Loss Equation (Villarreal 2014).

The study identified highly disturbed areas vulnerable to soil compaction and detected approximately 6,077 miles of unauthorized off-road tracks. Major disturbance hotspots occur along the U.S.-Mexico border road (Villarreal 2014). Considerable disturbance was also detected along the southern end of El Camino del Diablo Este and areas around Tractor Road and Military Drag (Villarreal 2014). The highest number of repeated disturbances occurred in the southern part of the hazard area, which is off-limits to OHV uses year-round (Villarreal 2014).

The disturbance mapping data and erosion potential models will help the BMGR West managers to quickly identify where off-road vehicle traffic will have the greatest negative impact on soil resources and allow for the designation of critically disturbed areas and restoration sites where off-road driving should be limited or avoided (Villarreal 2014).

Both the USAF and USMC utilize a formal, comprehensive Environmental Management System (EMS) and its Plan, Do, Check, Act cycle for ensuring mission success. Executive Order (EO) 13834, *Efficient Federal Operations*; DoDI 4715.17, *Environmental Management Systems*; AFI 32-7001, *Environmental Management*; and International Organization for Standardization (ISO) 14001 standard, *Environmental Management Systems – Requirements with guidance for use*, provide guidance on how environmental programs should be established, implemented, and maintained to operate under the EMS framework.

The natural resources program employs EMS-based processes to achieve compliance with all legal obligations and current policy drivers, effectively manage associated risks, and instill a culture of continual improvement. The INRMP serves as an administrative operational control that defines compliance-related activities and processes.

BMGR East

The 56 FW is assigned to Luke AFB and as such has purview over Luke, the BMGR East, and the Gila Bend AFAF as separate but related installations. The scope of Luke AFB's EMS includes all the activities, services, and products associated with the operations of the 56 FW and tenants.

The 56 RMO, Environmental Science Management (56 RMO/ESM), along with the 56 FW Civil Engineer Environmental Element effective program management, technical oversite and compliance of all environmental aspects of Gila Bend AFAF and the BMGR East. The 56 RMO manages the natural and cultural resources of Gila Bend AFAF and the BMGR East.

BMGR West

The USMC Headquarters and Headquarters Squadron enterprise includes MCAS Yuma and the BMGR West. Within the boundaries of MCAS Yuma, there are a number of tenant units. The scope of MCAS Yuma's EMS includes all the activities, services, and products associated with the operations of the MCAS Yuma and tenants.

The MCAS Yuma Environmental Department provides MCAS Yuma, the BMGR West, and tenants with effective program management, technical oversight, and compliance of all environmental aspects. The RMD manages the natural and cultural resource aspects of the BMGR West.

CHAPTER 4 GENERAL ROLES AND RESPONSIBILITIES

General roles and responsibilities necessary to implement and support the Natural Resources Program are listed in Table 4-1. Specific natural resources management-related roles and responsibilities are described in appropriate sections of this plan.

Table 4-1: The BMGR roles and responsibilities.

Office/Organization/Job Title (not in order of Hierarchical Responsibility)	Installation Role/Responsibility Description
RMO Director/Commanding Officer	The 56 FW Commander has delegated Range Operating Authority for oversight of all the BMGR East functions to the 56 RMO Director. The 56 RMO Director is the Range Operating Authority for the BMGR East and oversees the management and operational functions, including ESM operations. The MCAS Yuma Commanding Officer oversees the BMGR West Natural Resources Program. **Roles and Responsibilities** • Approves the INRMP by signature and certifies all INRMP updates. • Ensures that the INRMP is consistent with the use of the range to ensure the preparedness of the Armed Forces. • Controls access to and use of the BMGR's natural resources. • Commits to seeking funding and executing all "must fund" projects and activities within identified timeframe. • Provides appropriate staffing to execute INRMP implementation.
Air Force Civil Engineer Center Natural Resources Media Manager/Subject Matter Expert/Specialist	Advocates for resources and funding to implement approved INRMPs (BMGR East only).
Installation Natural Resources Manager/Point of Contact	• Supports military training by managing the natural resources of the range in accordance with applicable laws, EO, and directives. • Coordinates INRMP updates, revisions, and implementation requirements with applicable federal, state, and tribal government agencies, as well as nongovernmental organizations and parties.
Installation Unit Environmental Coordinators (UECs); see AFI 32-7001 (USAF 2017a) for role description	Conducts UEC duties as required (BMGR East only).

Table 4-1: The BMGR roles and responsibilities.

Office/Organization/Job Title (not in order of Hierarchical Responsibility)	Installation Role/Responsibility Description
Installation Wildland Fire Program Manager	BMGR East is updating their WFMP. WFMP should be finalized sometime at the beginning of 2021. BMGR West WFMP is finalized. Each WFMP assigns roles/responsibilities in accordance with this INRMP.
Pest Manager	• Primary point of contact for all range pesticide use. • Assists natural resources staff with the safe, effective, economical, and environmentally acceptable management of pests.
Range Operating Agency	• The 56 RMO is the Range Operating Agency for the BMGR East and oversees the ESM section. • The MCAS Yuma RMD advises the Commanding Officer in order to meet INRMP goals and objectives.
Conservation Law Enforcement Officer (CLEO)	• Enforces natural and cultural resource laws. • Addresses trespass issues. • Assists natural resource personnel with INRMP implementation. • Collects GIS coordinates of invasive species using the GIS Cloud app.
NEPA/Environmental Impact Analysis Process Manager	Conducts NEPA/Environmental Impact Analysis Process for all installation projects in coordination with the Natural Resources and Environmental Managers.
U.S. Forest Service	Assists the BMGR East with preparation of the Wildland Fire Management Plan.

Table 4-1: The BMGR roles and responsibilities.

Office/Organization/Job Title (not in order of Hierarchical Responsibility)	**Installation Role/Responsibility Description**
Arizona Game and Fish Department	• Primary jurisdiction over wildlife management, except where pre-empted by federal law. • Provides assistance for INRMP development and implementation through the 2015 Cooperative Agreement (U.S. Army Corps of Engineers and AGFD 2015). • Develops and maintains habitat assessment/evaluation, protection, management, and enhancement projects (e.g., wildlife water catchments, Sonoran pronghorn forage plots). • Conduct a wildlife monitoring across the range. • Manages wildlife predators and recovery of protected species in accordance with the ESA, shared responsibility with the USFWS. • Enforces hunting regulations, issue hunting permits, and establish game limits. • Participating agency on the BEC and IEC.
U.S. Fish and Wildlife Service	• Provides assistance for INRMP development and implementation. • Manages recovery of protected species in accordance with the ESA—shared responsibility with the AGFD; leads the Sonoran Pronghorn Recovery Team. • Manages the MBTA and BGEPA. • Participating agency on the BEC and IEC.

CHAPTER 5 TRAINING

USAF and USMC installation Natural Resource Managers/Points of Contacts and other natural resources support personnel require specific education, training and work experience to adequately perform their jobs. Section 107 of the Sikes Act requires that professionally trained personnel perform the tasks necessary to revise and carry out certain actions required within this INRMP. Specific training and certification may be necessary to maintain a level of competence in relevant areas as installation needs change, or to fulfill a permitting requirement.

Trainings for BMGR natural resource support personnel are listed below.

- All Natural Resource Managers (NRMs) are required to complete *DoD Natural Resources Compliance.*
- All personnel tasked with handling or managing threatened and endangered species should complete *Interagency Consultation for Endangered Species* and/or other ESA related courses.
- Natural resource management personnel shall be encouraged to attain professional registration, certification, or licensing for their related fields and may be allowed to attend appropriate national, regional, and state conferences and training courses.
- CLEOs must receive specialized, professional training on the enforcement of fish, wildlife, and natural resources laws in compliance with the Sikes Act. This training may be obtained by successfully completing the Land Management Police Training course at the Federal Law Enforcement Training Center (http://www.fletc.gov/).
- Individuals participating in the capture and handling of sick, injured, or nuisance wildlife should receive appropriate training.
- Personnel supporting the BASH program should receive training in submitting remains to the Smithsonian for identification and flight-line driver training.
- The DoD-supported publications and webinars provide guidance, case studies and other information.

CHAPTER 6 RECORDKEEPING AND REPORTING

6.1 Recordkeeping

Records must be maintained to support implementation of the Natural Resources Programs. Specific records are identified in applicable sections of this plan and in referenced documents.

BMGR East

The BMGR East maintains required records in accordance with USAF Manual 33-363, *Management of Records* (USAF 2017b) Records are disposed in accordance with USAF Records Information Management System records disposition schedule.

All natural resources-related documentation for the BMGR East is stored and maintained at the 56 RMO office, Building 500 on Luke AFB. Administrative files are stored at the USAF repository at the Gila Bend AFAF. The 56 RMO maintains a GIS server for the BMGR East data, which resides in the 56th Comm Network Communication Center and is on the Non-classified Internet Protocol Router Network (NIPRNet).

BMGR West

The BMGR West maintains required records and disposes of records in accordance with Navy Marine Corps Directive 5210.11E, *Marine Corps Records Management Program* (USMC 2006).

All natural resources-related documentation and GIS shapefiles for the BMGR West are stored and maintained at the Range Management Building 151 on MCAS Yuma.

6.2 Reporting

BMGR East

The BMGR East NRMs are responsible for responding to natural resources-related data calls and reporting requirements. The Natural Resources Manager and supporting Air Force Civil Engineer Center Media Manager and Subject Matter Specialists should refer to the Environmental Reporting Playbook for guidance on execution of data gathering, quality control/quality assurance, and report development.

BMGR West

The BMGR West NRMs are required to respond to natural resources-related data calls and reporting requirements per MCO 5090.2 (USMC 2018).

CHAPTER 7 NATURAL RESOURCES PROGRAM MANAGEMENT

There have been no changes in the 17 management elements outlined in the 2012 INRMP. In planning for the next five years, MCAS Yuma and Luke AFB have each developed a preliminary list of proposed action steps for FY 2019–2023. These action steps were identified by considering data acquired through inventory and monitoring activities in the past five years, changes that have occurred in the past five years (as reported in earlier chapters of this INRMP revision), emerging management issues, and input from other agencies with land management or regulatory authority in the BMGR region. The resource management elements, listed below, are detailed in Chapter 10, *Annual Work Plans*.

1. Resource inventory and monitoring
2. Special natural/interest areas
3. Motorized access and non-roaded area management
4. Camping and visitor stay limits
5. Recreation services and use supervision
6. Rock hounding
7. Wood cutting, gathering, and firewood use; and collection of native plants
8. Hunting
9. Recreational (target) shooting
10. Utility/transportation corridors
11. General vegetation, wildlife, wildlife habitat, and wildlife water
12. Special status species
13. Soil and water resources
14. Air resources
15. Visual resources
16. Wildfire management
17. Perimeter land use, encroachment, and regional planning

7.1 Fish and Wildlife Management

Existing inventories show that over 200 bird species, more than 60 species of mammals, 10 amphibian species, and over 50 reptile species potentially occur within the combined area of BMGR and the adjacent Cabeza Prieta NWR. Available evidence indicates that the diversity of wildlife species and habitats present in 1941 when the BMGR was established continue to be found within the range today. Moreover, species populations appear to be relatively stable and typical for this portion of the Sonoran Desert. This may be attributed to a number of factors.

- The land is withdrawn for military use, which has excluded or limited other land uses—such as livestock grazing, farming, mining, and intensive off-road vehicle recreation—that could have altered physical and biological systems to a greater extent than that associated

with military training.

- Ecological interconnections between BMGR, two national monuments, and one national wildlife refuge have remained unfragmented and undiminished.
- The primary land use—aviation training—has limited on-the-ground disturbances of soils and vegetation to relatively small and dispersed portions of the range.
- Restrictions and limits on public access and use have left many portions of the range free of disturbances from intensive and concentrated recreation activities.
- The BMGR is far from major metropolitan areas, which minimizes d public- visitation pressure and the effects of prolonged, intensive use.
- As a result of surface drainage patterns on and around the range, its hydrological features are relatively isolated, which protects them from upstream sources of water-borne pollutants, sedimentation, and watershed modifications.

AGFD has management authority for the state's wildlife, which is held in trust for the citizens of the State of Arizona. This authority applies to the BMGR unless otherwise pre-empted by federal law. AGFD began its management activities at BMGR in the 1950s, when it established water sources for wildlife (see Section 7.5), which the agency still maintains today. AGFD also organizes and conducts bighorn sheep and deer surveys at BMGR every three years, annual call-counts of mourning (*Zenaida macroura*) and white-winged doves (*Z. asiatica*) at Range 3 and ETAC, and Le Conte's thrasher (*Toxostoma lecontei*) surveys within both the BMGR East and West. At BMGR West, AGFD also performs annual surveys for the FTHL, speckled rattlesnake (*Crotalus mitchellii*), and bats.

BMGR East

In August 2015, the U.S. Army Corps of Engineers (USACE) Omaha District and AGFD entered into a five-year cooperative agreement to "collect, analyze, and apply environmental and cultural resource data and implement land rehabilitation and maintenance for optimal management of lands under control of the DoD. . . ." (USACE and AGFD 2015). The agreement facilitates AGFD management activities at BMGR East, which typically include conducting wildlife surveys to track population trends, providing recommendations based on survey data for restoring or maintaining populations of resident species, managing wildlife populations at levels appropriate for protecting other BMGR resource values, and enforcing state game laws.

Collaborative efforts with AGFD and other partners include implementing actions to comply with the Sonoran Pronghorn Recovery Plan and conducting a number of other wildlife activities during the FY 2019–2023 timeframe. Recurring surveys are planned for desert tortoise (every 5 years), birds (years 1 and 2), kit fox (*Vulpes macrotis*) (years 1 and 4), and cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*) (bi-annually). Surveys for raptors and bats will occur annually.

In-house staff and partners will continue the ongoing effort to control invasive species to improve wildlife habitat and identify and maintain important wildlife connectivity corridors. Additional habitat enhancements and restoration activities will be undertaken as needed.

A complete list of wildlife surveys and habitat improvement projects planned for the next five years can be found in Table 10-1 *BMGR East 5-Year Work Plan: FY 2019–2023.* Sensitive species monitoring

and conservation projects are discussed in detail in Section 7.4 *Management of Threatened and Endangered Species.*

BMGR West

In 2016, the first comprehensive inventory of amphibians, reptiles, and small mammals was initiated at BMGR West. This his project will last for three years, concluding in 2018, to accomplish three objectives: (1) create maps indicating species distribution, (2) identify an efficient, repeatable monitoring methodology, and (3) develop recommendations for monitoring and managing wildlife species.

Additional wildlife surveys and habitat improvement projects planned for the next five years can be found in the *BMGR West Five-Year Work Plan* (Chapter 10 *Annual Work* Plans, Table 10-2). Management actions for threatened and endangered species are discussed in more detail in relevant subsections of Section 7.4 *Management of Threatened and Endangered Species*.

7.1.1 Camera Trapping

Beginning in 2008, camera trapping has been used extensively on both BMGR East and West. Camera traps are set up to quantify wildlife use of various water development types in specific surroundings. Camera traps are deployed at both artificial catchments and modified tinaja*s* within 20 feet of sites where animals would come to drink. Trapping sites are typically visited once a month to inspect equipment for operability, replace batteries, and download data. These data aid in understanding the variety of species usage, wildlife behaviors, and population sizes. The data also may be used to assess wildlife occupancy by vegetation type, elevation, and structure type (e.g., artificial structure or modified *tinaja*), and whether or not wildlife usage differs near military targets.

Camera traps also record the use of wildlife watering sites by trespass livestock and UDAs; just one catchment camera recorded over 60 UDA visits in 2012 alone. The cameras have captured UDAs drinking from the waters and tampering with tank float valves, dismantling and stealing cameras, disturbing wildlife, and leaving garbage around catchments. UDA and trespass livestock use of wildlife watering sites also increases the amount and frequency of water that must be hauled in by AGFD.

7.1.2 Climate Impacts on Fish and Wildlife Management

Wildlife management is not likely to need to change substantially with respect to climate change, but current wildlife management issues are likely to persist or become more pronounced in the future. Management plans should be flexible enough to adapt to changing wildlife concerns (Hellmann et al. 2008).

Wildlife surveys should continue to be conducted on a regular basis to monitor and document changes in native species. Changing climatic conditions may present opportunities for invasive species to flourish and push out native species, so invasive species monitoring will also continue to be important.

Water resources at BMGR are important components of wildlife habitat, so managers may need to adjust to changes in water quantity and quality due to climate change. Rising temperatures may impact water quantity and quality, which managers can address in some areas by constructing artificial shade structures such as awnings, pergolas, etc. to prevent evaporation and/or lower dissolved oxygen due to rising temperatures (Poff et al. 2002). Erosion due to wildland fires (Section 7.9) and changing vegetation (Section 2.3.2.1) may further impact water quality, so wildland fire management and vegetation management will continue to be important wildlife management tools.

7.2 Outdoor Recreation and Public Access to Natural Resources

BMGR offers a variety of public recreation activities as well as access to natural areas. Approximately 38 percent of the range is open to the public (Figure 7.1). Permitted activities include camping, hiking, hunting, and target shooting. Range permits allow entry to both the BMGR East and West public areas, Cabeza Prieta NWR, and the Sonoran Desert NM. Range access permits are available online via iSportsman (https:luke.isportsman.net). All visitors are required to sign a hold-harmless form and watch a range safety video. Two permits are required: one to be kept in personal possession at all times and the other to be displayed on the vehicle's dash. Prior to entering the range, recreational users must call the phone number listed on the back of the permit to hear warning information for specific travel areas. Individuals under the age of 18 must be accompanied by an adult at all times. Any person entering the range without a valid permit may be fined and/or barred from the BMGR.

The iSportsman online permit program allows visitors to register and print a permit, sign a digital hold-harmless form, watch the range safety video, and check in and out of an area via smartphone app or a phone call. Additionally, the 56 RMO can develop a custom report that all users must fill out to detail which area of the range they will be visiting, the duration of the visit, type of activities to be conducted, and any other information that will assist the 56 RMO with carrying out its natural and cultural resources management mission.

Individuals interested in conducting scientific research at BMGR are required to obtain permission from the 56 RMO or the MCAS Yuma RMD. For collecting wildlife specimens, a Scientific Collection Permit application is also required and must be approved by AGFD.

The following activities are prohibited or the applicant must pass a background check to obtain a Special Use Permit for the activity.

- Use of drones/unmanned aerial vehicles (prohibited)
- Parties with 10 or more vehicles
- Discharge of firearms before sunrise or after sunset
- Discharge of fully automatic firearms
- Extended camping
- Scientific studies of any type
- Collecting wildlife specimens (requires additional approval by AGFD)

All public recreational users of the range are expected to comply with range rules. Cross-country and off-road travel is strictly prohibited—all vehicles are required to remain on designated roads. At Cabeza Prieta NWR, vehicles are restricted to the Camino del Diablo and Christmas Pass Roads. In general, roads are to be considered closed unless designated open by an official carsonite marker post (at BMGR East) or a 4-foot wide by 4-foot high, lettered/numbered, wooden intersection marker (at BMGR West). Disturbance or removal of cultural resources/artifacts (e.g., pottery, chipped stone, ground stone, shell, beads, glass bottles, ceramics, cans, metal, lumber, pictographs, and arrowheads) is strictly prohibited.

In the past, visitor gates at BMGR East have been augmented with counters and cameras, and this may be re-implemented in the future. Cameras can capture images of who is using the range and for what purpose. The practice of leaving food, water, clothes, and medical supplies along UDA foot trails has led to increased litter and trash, which the military is responsible for cleaning up. If identified, such groups will be escorted off the range, have their permits revoked, and may face investigation and prosecution from BMGR East and West CLEOs and BP.

BMGR East

Approximately 13 percent of BMGR East is open for public recreation (Figure 7.1). The three BMGR East public use areas include: Area B (~128,000 acres), Bender Springs (~3,100 acres), and Ajo Air Station (~4,000 acres). Visitors to the BMGR East must abide by these range-specific rules.

- *Rock hounding/Prospecting and Geocaching*—Removal or disturbance of sand, gravel, rocks, minerals, and fossils is strictly prohibited.
- *Hazard Areas*—For safety reasons, the 56 RMO has established "Hazard Areas" that are off-limits to permit holders when the range is open. This restriction affects access to the northernmost portions of Area B.
- *Hunting*—Hunting is restricted to public access areas. Public access areas east of SR 85 fall under the AGFD hunting Unit 40A (AGFD 2017b). Species that may be hunted within this area include bighorn sheep, javelina, deer, dove, and quail. The number of bighorn sheep permits made available have varied over the last 10 years due to population fluctuations. Between 2008 and 2013, no bighorn sheep permits were available due to population decline, and in 2014 only one permit was available. Another slight increase in population size since 2015 resulted in two permits being available each year for 2015, 2016, and 2017. The number of bighorn sheep permits is determined by results of population surveys conducted by AGFD. Public access areas west of SR 85 on BMGR East (i.e., area near Ajo) and the hunting unit in BMGR West are all part of the same AGFD hunting unit: 40B (as described below under BMGR West).

BMGR West

Approximately 75 percent of the BMGR West is open for public recreation (Figure 7.1). Visitors to the BMGR West must abide by these range-specific rules.

- *Rock hounding*—Surface-rock collection is allowed in most of the BMGR West public recreation areas. Collection is limited to 25 pounds of surface rock per day and 250 pounds

per year. The use of metal detectors is strictly prohibited.

- *Hunting*—Hunting within the publicly accessible portions of the BMGR West falls under the AGFD hunting Unit 40B (AGFD 2017b). Species that may be hunted within this unit include bighorn sheep, javelina, deer, dove, quail, waterfowl, and pheasant, although the presence of waterfowl and pheasants is extremely unlikely. As with BMGR East, the number of bighorn sheep permits made available has varied over the last 10 years due to population fluctuations. Currently, 8 bighorn sheep permits are available annually with four tags being issued for the Gila Mountains, two tags for the Tinajas Mountains, and two tags issued for the Copper and Mohawk Mountains. The number of bighorn sheep permits to be made available is assessed annually and is based on results of population surveys conducted by AGFD.

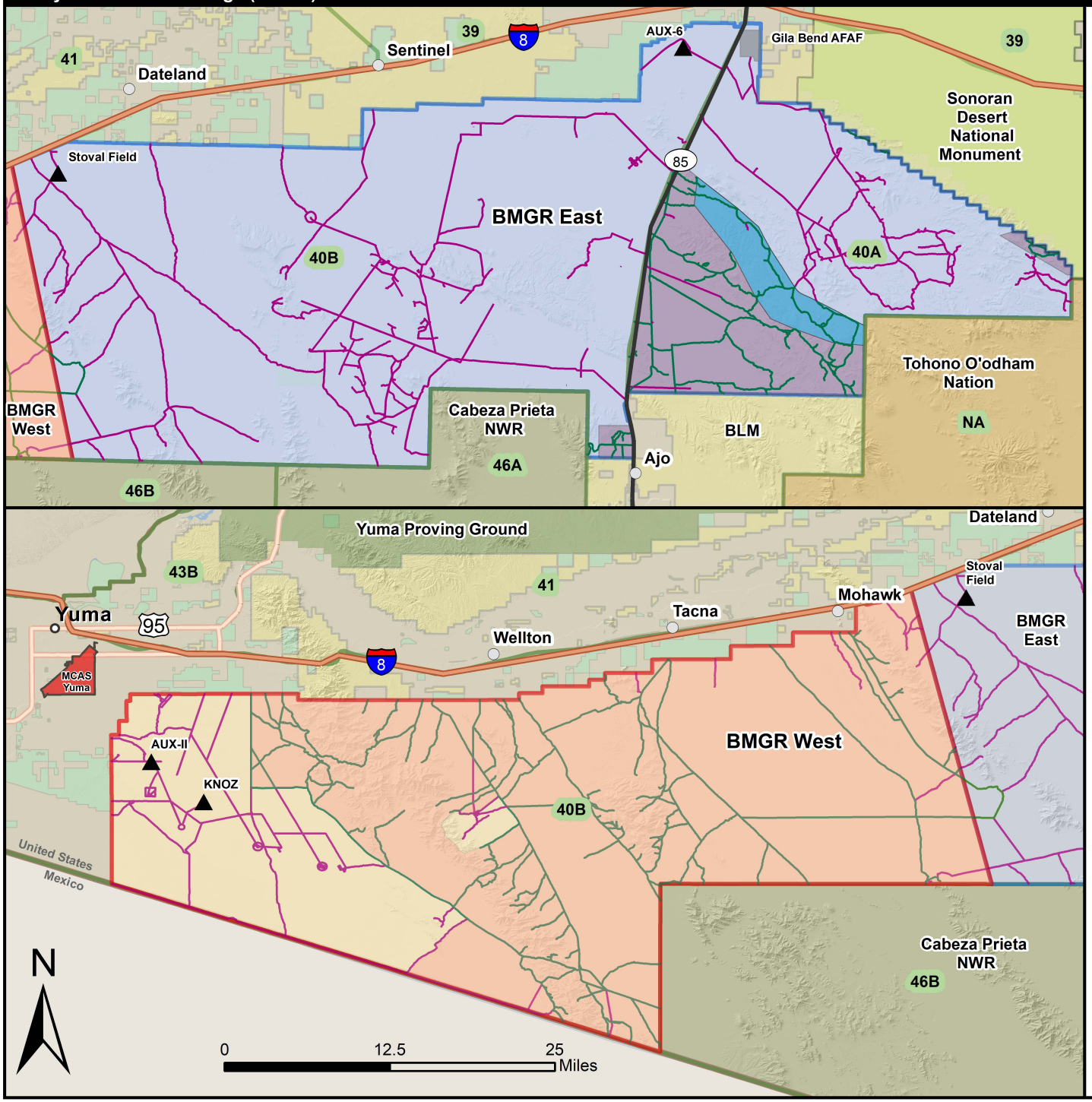
7.2.1 Climate Impacts on Outdoor Recreation

Few changes to outdoor recreation and public access to natural areas are expected due to climate change. Activities such as camping, hiking, and target shooting may continue without any changes, though managers should be aware of added safety risks due to more extreme temperatures. Hunting opportunities will need to be frequently assessed as environmental conditions shift. Common species such as javelina, mule deer, doves, and quail will likely persist. Because waterfowl are extremely unlikely to occur in the area and bighorn sheep populations can vary, opportunities for hunting these less common species will need to be frequently evaluated based on population size on the range.

Figure 7.1: BMGR Public Recreation

Barry M. Goldwater Range (BMGR)

2018-2023 Integrated Natural Resource Management Plan (INRMP)



Legend

- City/Town
- Interstate 8
- Highways
- Auxiliary Airfield (AUX)
- BMGR West
- BMGR East
- Gila Bend AFAF
- Yuma Proving Ground
- Cabeza Prieta NWR
- Sonoran Desert NM
- Tohono O'odham Nation
- MCAS Yuma
- BLM
- State Trust Land
- Arizona G&F Game Managements Units
- Hazard Area - Access is only granted when range is closed. Valid permit required.
- BMGR East Public Access
- BMGR West Public Access
- BMGR Designated Admin Use Only Road
- BMGR Designated Public and Admin Use Road

World Geodetic System 1984 (WGS84) Projection
Zone 11 and 12 N
GCS_WGS_1984

Base data from ESRI StreetMap
Hillshade derived from USGS NED

Created By:
Center for Environmental Management
MILITARY LANDS
Colorado State University

7.3 Conservation Law Enforcement

Law enforcement on the range is defined within the Sikes Act; Assimilative Crimes Act, 18 U.S.C. § 13; Uniform Code of Military Justice, 10 U.S.C. § 807(b); and other applicable laws and regulations. The Sikes Act mandates each military department to ensure that sufficient numbers of professionally trained CLEOs are available and assigned responsibility to perform tasks to implement INRMPs. Enforcement of natural resource laws is a fundamental part of a Natural Resources Program and shall be coordinated under the direction of the Natural Resources Manager (Code of Federal Regulations Title 32, National Defense, as revised in 2018). Because the ICRMP is incorporated (i.e., referenced as appropriate) into the INRMP, the USAF and USMC also must enforce laws and regulations that protect cultural resources.

In addition to conducting enforcement activities, CLEOs serve as the eyes and ears of the range. CLEOs assist with conservation activities such as wildlife surveys, habitat restoration, water projects, formulating hunting objectives, monitoring protected species, and resolving nuisance and human/wildlife conflicts. CLEOs patrol and/or conduct surveillance where there is a potential for poaching or cultural resource vandalism. CLEOs also play a role in slowing the spread of invasive species, as they spend a majority of their time patrolling the range and may be the first to identify such species. They assist NRMs by using the GIS Cloud app to record the GPS coordinates and capture images of invasive species to facilitate prompt management actions.

Integral to resource protection is public education and outreach. Education is a key element in preventative law enforcement. Successful conservation law enforcement is enhanced by the knowledge gained in contributing to natural and cultural resources program support.

BMGR East

The 56 RMO entered into a contractual agreement with AGFD to employ two Department Wildlife Managers as CLEOs for the BMGR East in 2016. AGFD CLEO services began in October 2017 and the contract was ultimately terminated December 2019.

The USFWS has recently partnered with the USAF to provide CLEO service support to installations across the country. BMGR East is currently on the USFWS list to receive two authorized and credentialed CLEO functions via Federal Wildlife Officers (FWO). As of July 2020, It is unclear when BMGR East will receive the FWOs, however due to COVID-19 the development process has been delayed. The 56 RMO is working closely with USAF and USFWS leadership on a potential start date sometime during fiscal year 2021.

The FWOs will be tasked with enforcing federal and state laws. Patrol requirements will consist of enforcement of installation regulations for outdoor recreation, state hunting laws, ESA, Archeological Resources Protection Act, and other conservation laws, prevent illegal trespass and dumping, enforcing off-highway and all-terrain vehicle use rules, advise and assist outdoor recreation participants to ensure their safety, and prevent conflicts with military testing and training activities.

The FWOs have authority to conduct investigations and issue citations, serve warrants, make arrests, coordinate case prosecution with county attorneys and the 56 FW Staff Judge Advocate, and provide

testimony in court. The FWOs will support the military and conservation goals through implementation of the INRMP and ICRMP, as requested/directed by the 56 RMO.

BMGR West

MCAS Yuma employs four full-time Range Wardens (CLEOs) to investigate, apprehend, and/or detain individuals suspected of breaking the laws and regulations that pertain to MCAS Yuma, BMGR West, and the Chocolate Mountain Aerial Gunnery Range, with an emphasis on protecting natural resources. CLEOs are uniformed law enforcement officers with fully delegated law enforcement authority, including authority as USFWS Deputy Game Wardens, allowing them to enforce federal wildlife statutes (MCAS Yuma 2013c).

7.4 Management of Threatened and Endangered Species

7.4.1 Sonoran Pronghorn

Figure 7.2: Sonoran pronghorn fawns are being raised in the captive-breeding pen that was built at Cabeza Prieta NWR in 2003.

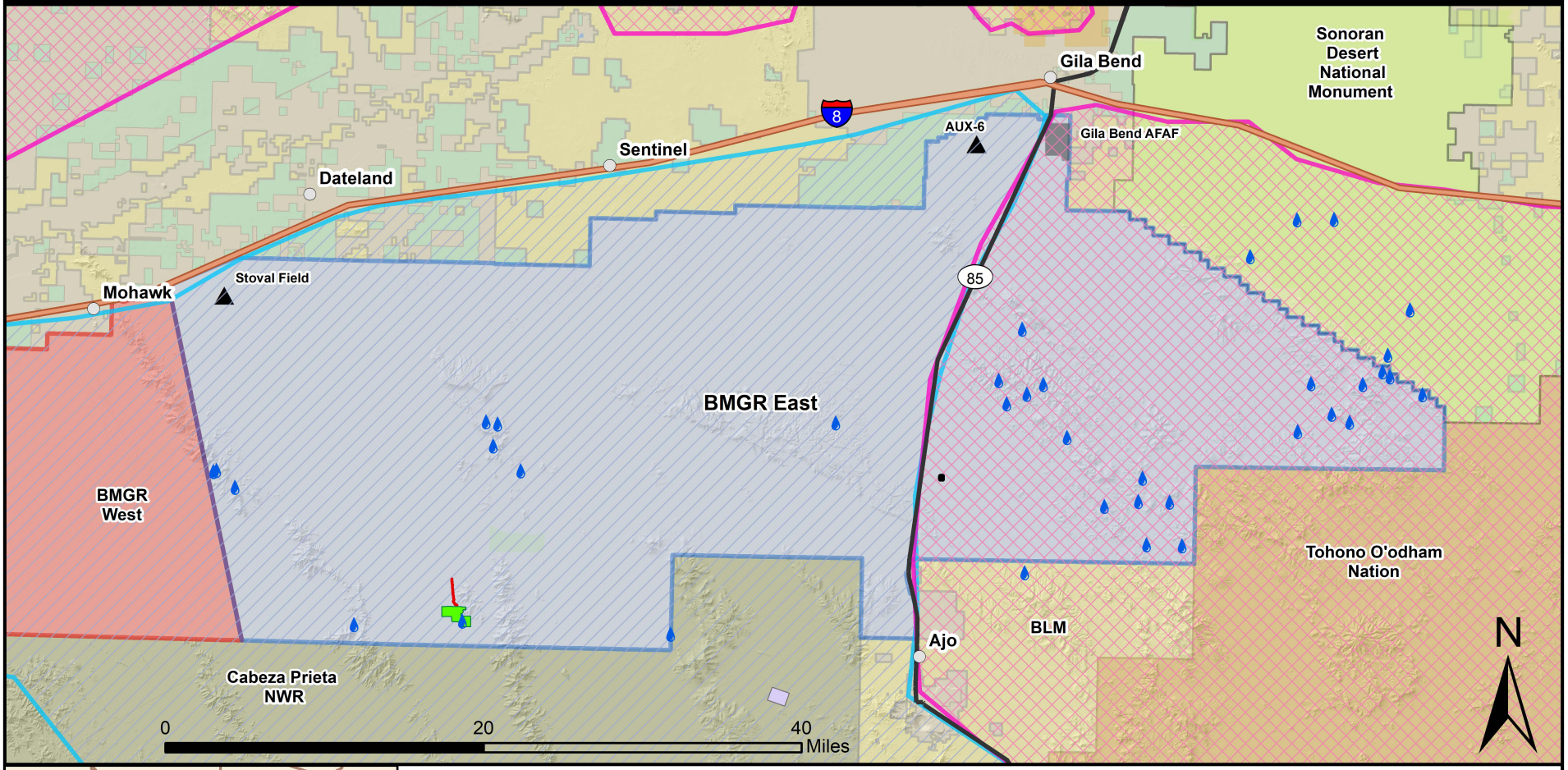
The Sonoran pronghorn has been listed as a federally endangered species since 1967. Whereas methods and geographic study areas used to estimate the Sonoran pronghorn population have varied over time, estimates from 1925 through 1991 indicate that relatively low numbers of pronghorn (approximately 50–150 animals) were present in southwestern Arizona during that time. Sonoran pronghorn, however, were more abundant prior to European settlement (USFWS 2016). The area of pronghorn distribution has become smaller over the years as a result of habitat loss and fragmentation (USFWS 2016). However, the methods and geographic study areas used to estimate the pronghorn population have also varied over time. In 1992, AGFD initiated regular biennial aerial surveys of the Sonoran pronghorn population. Based on these surveys, the U.S. population peaked at an estimated 282 animals in 1994, and the population low was estimated at 21 to 33 animals in 2002 after a severe drought.

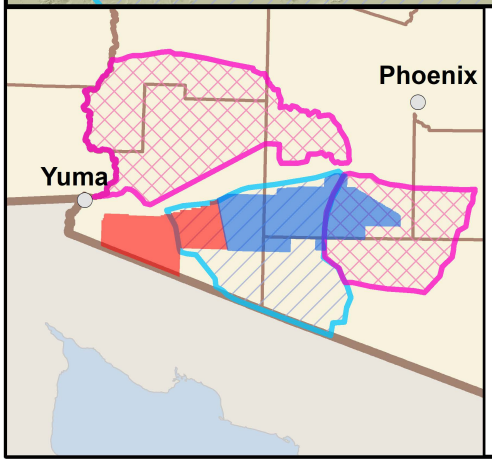
The pronghorn's current range includes portions of BMGR East (Figure 7.3) and BMGR West (Figure 7.4). The USAF and USMC actively participate in and financially support the Sonoran Pronghorn Recovery Plan and the actions of the Sonoran Pronghorn Recovery Team. Led by the USFWS, the recovery team generally consists of representatives from the Luke AFB, MCAS Yuma, AGFD, NPS (from Organ Pipe Cactus NM), BLM (from the Lower Sonoran Field Office), ASU, UA, Commission for Ecology and Sustainable Development of the State of Sonora (Mexico), National Commission for Protected Natural Areas (Mexico), Phoenix and Los Angeles Zoos, Customs and Border Protection, and the Tohono O'odham Nation (membership changes occasionally when staff turnover occurs).

Figure 7.3: Protected Species Management BMGR East

Barry M. Goldwater Range (BMGR)

2018-2023 Integrated Natural Resource Management Plan (INRMP)





Legend

- City/Town
- Interstate 8
- State Route 85
- BMGR East
- BMGR West
- Gila Bend AFAF
- Cabeza Prieta NWR
- Sonoran Desert NM
- Tohono O'odham Nation
- BLM
- State Trust Land
- Sonoran Pronghorn Semi-Captive Breeding Enclosure at Cabeza Prieta NWR
- Sonoran Pronghorn Granite Mtn Forage Plot Current
- Sonoran Pronghorn Granite Mtn Forage Plot Future Expansion
- Sonoran Pronghorn Area B Recovery Pen
- Sonoran Pronghorn 10(j) Re-establishment Areas
- Endangered Sonoran Pronghorn US Range
- Auxiliary Airfield (AUX)
- Arizona G&F Wildlife Waters

World Geodetic System 1984 (WGS84) Projection
Zone 12 N
GCS_WGS_1984

Base data from ESRI StreetMap Hillshade derived from USGS NED

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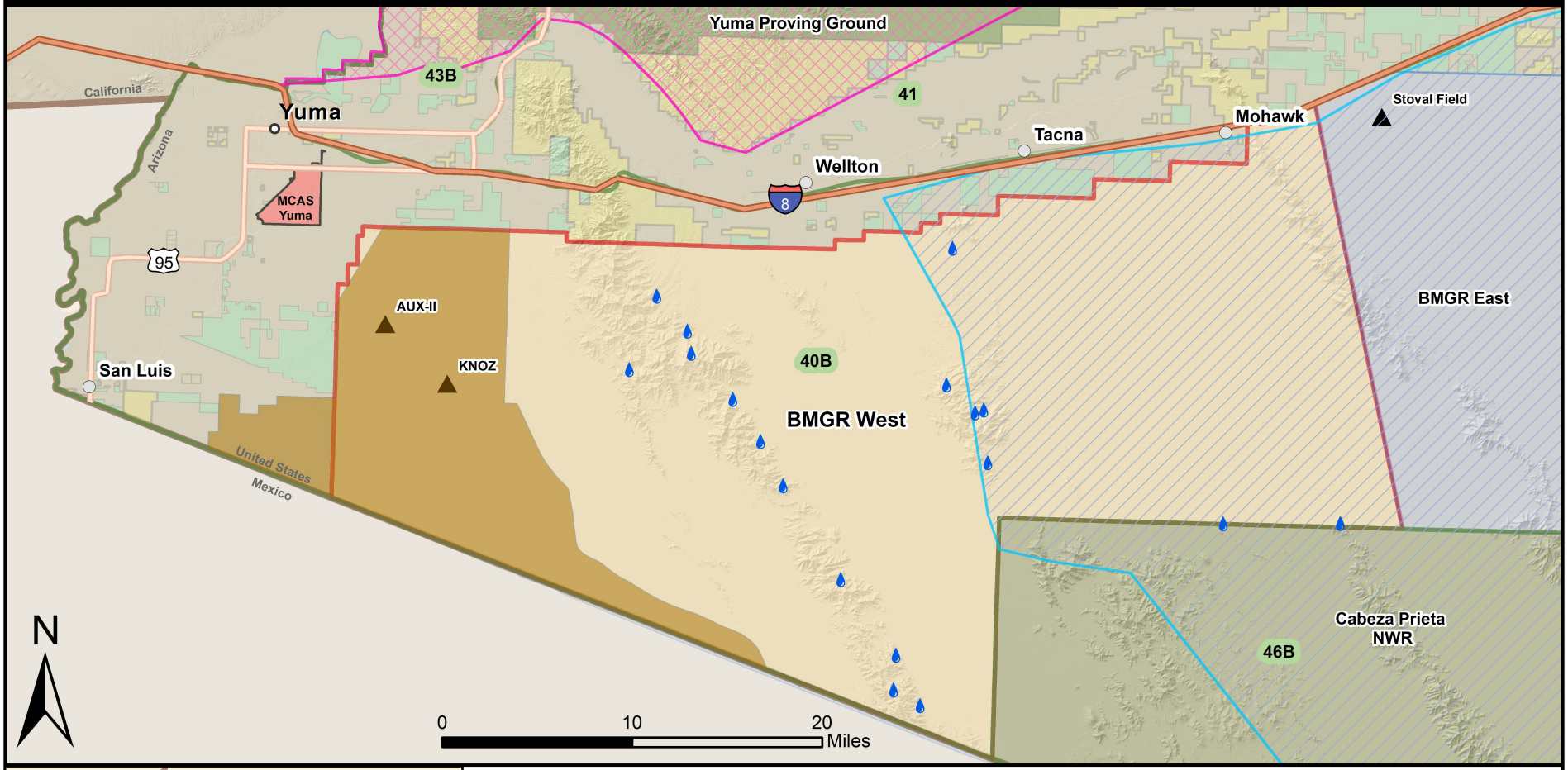
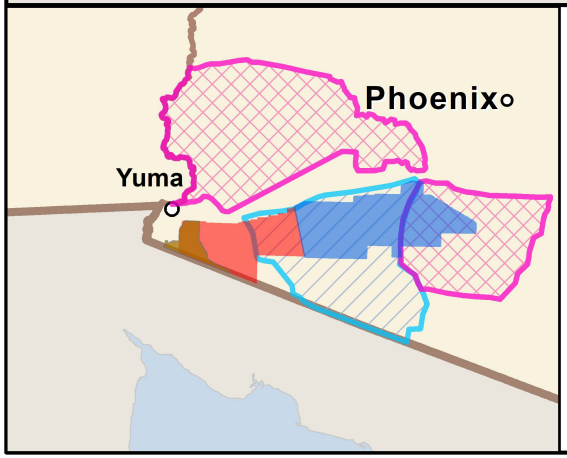
Figure 7.4: Protected Species Management BMGR West

Barry M. Goldwater Range (BMGR)

2018-2023 Integrated Natural Resource Management Plan (INRMP)





Legend

- City/Town
- Interstates
- Highways
- MCAS Yuma
- BMGR East
- BMGR West
- Yuma Proving Ground
- Cabeza Prieta NWR
- BLM
- State Trust Land
- Flat-Tail Horned Lizard Habitat Area
- Sonoran Pronghorn 10(j) Re-establishment Areas
- Endangered Sonoran Pronghorn US Range
- Arizona G&F Game Managements Units
- Auxiliary Airfield (AUX)
- Arizona G&F Wildlife Waters

World Geodetic System
1984 (WGS84) Projection
Zone 11 N
GCS_WGS_1984

Base data from ESRI StreetMap
Hillshade derived from USGS NED

Created By:
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Concerted efforts of the USAF, USMC, AGFD, USFWS, and other members of the recovery team have resulted in improved status of Sonoran pronghorn through the implementation of numerous recovery actions. Key actions have included the initiation of the semi-captive breeding programs at the Cabeza Prieta NWR (2003) and later at Kofa NWR (2011), and the establishment of two nonessential experimental populations, as allowed by Section 10(j) of the ESA, one centered at Kofa NWR and the other centered on Area B of BMGR East. A nonessential experimental population is a special designation that the USFWS can apply to a population of a threatened or endangered species prior to reestablishing it in an unoccupied portion of its former range.

These and other actions of the recovery plan, if successful, will ultimately lead to downlisting and delisting of the species. However, the increased numbers of animals on the range has the potential to constrain BMGR's mission. The USFWS continues to work with the military to reduce mission constraints and minimize risks to pronghorn from military operations. For example, in 2010, the USFWS issued a non-jeopardy biological opinion that allowed for reduced target-closure distances, as described below. Additionally, the USFWS has provided the pronghorn with food and water near the range boundaries (east, west, and south) to lure the animals away from actively used targets.

To reduce potential impacts to pronghorn due to military exercises (e.g., ordnance delivery) at BMGR East, daily monitoring of target areas occurs on NTAC, STAC and Range 1 when EOD operations or weapons employment is expected. Monitoring is conducted by qualified biologists and includes visual observations from vantage points with the aid of binoculars and spotting scopes, as well as telemetry surveillance to locate pronghorn.

Per the proposed action in the 2010 biological opinion, if a pronghorn is sighted within a 3.1-mile radius of high explosive ordnance targets, on either NTAC or STAC, then the training mission will be canceled or diverted to a different tactical range (USFWS 2010b). Additionally, no ordnance deliveries of any kind (e.g., inert ordnance) would be authorized within a 1.9-mile radius of the pronghorn location on the tactical ranges for the remainder of the day. On Range 1, strafe activities will be suspended for the day if a pronghorn is located within a 1.9-mile radius of a target and no ordnance of any type will be released if a pronghorn is within a 0.6-mile radius of a target. If a vehicle is within a 1.5-mile radius from a pronghorn, a reduced speed is required (15 mph).

Additionally, several pronghorn watering sites, irrigated forage plots, and supplemental feed stations have been established to help pronghorn populations survive the dry Southwest summers. The goal is to conserve and protect the Sonoran pronghorn and its habitat so that its long-term survival is secured and it can be removed from the list of threatened and endangered species. Specific recovery goal objectives are listed below.

- Ensure multiple viable populations of Sonoran pronghorn range-wide.
- Ensure that there are adequate quantity, quality, and connectivity of Sonoran pronghorn habitat to support their populations.
- Minimize and mitigate the effects of human disturbance on Sonoran pronghorn.
- Identify and address priority monitoring needs.
- Identify and conduct priority research.

- Maintain existing partnerships and develop new partnerships to support Sonoran pronghorn recovery.
- Secure adequate funding to implement recovery actions for Sonoran pronghorn.
- Practice adaptive management in which recovery is monitored and recovery tasks are revised by the USFWS in coordination with the Recovery Team as new information becomes available.

The Sonoran pronghorn recovery efforts are a great success story for endangered species management. Although breeding pen populations fluctuate every year due to fawn recruitment and pronghorn relocation, biennial population surveys of the wild populations last conducted by AGFD in December of 2016 estimated 228 individuals in the endangered population, referred to as the Cabeza population. As of Fall 2017, informal surveys resulted in estimates of about 70 individuals in the Kofa population (Christa Weise, USFWS, personal communication, December 2017) and 40 individuals in Area B (or Sauceda) populations.

AGFD distributes a monthly Sonoran pronghorn update, which summarizes the captive breeding program, wild pronghorn numbers, water projects, forage enhancements, and related projects. The updates cover the entire U.S. pronghorn distribution, with certain aspects pertaining to the BMGR.

7.4.1.1 Climate Impacts on Sonoran Pronghorn (*Antilocapra americana sonoriensis*)

Sonoran pronghorn require large expanses of continuous habitat suitable for foraging, access to water, and predator detection and avoidance. The species is highly nomadic, which is a response to the sporadic rainfall within its habitat. Climate change will create added pressures on the Sonoran pronghorn due to extended drought, especially during April, May and June. Warmer temperatures and greater evapotranspiration during these months could cause greater thermal stress, degrade foraging habitat (Gedir et al. 2015; USFWS 2010), and reduce the availability of naturally-occurring water resources (USFWS 2016). Human intervention, including the provisioning of artificial water sources, will continue to be important for supporting Sonoran pronghorn numbers (DeVos and Miller 2006).

7.4.2 Desert Tortoise

In 2015, a Candidate Conservation Agreement for the Sonoran desert tortoise was developed as a collaborative and cooperative effort between land and resource management agencies, including the BMGR managing agencies (USAF and USMC). The key effort of the conservation strategy is to focus on conservation, habitat improvement, and ongoing management of the tortoise status and habitat. Some of the key actions implemented by the BMGR East to protect the tortoise are listed below.

- Public access is only allowed by permit in certain areas and visitors (recreational users) are required to watch a safety video that includes natural resource conservation practices.
- All recreational vehicular travel is restricted to designated roads.
- Off-road travel by official vehicles is highly restricted, with extreme exceptions for activities such as clearance of unexploded ordnance.
- Designated speed limits are established for all roads.

- A Fire Management Plan was developed to reduce the potential for wildland fires, which are detrimental to Sonoran desert tortoise habitat.
- An invasive weed monitoring and eradication program is followed, with the aim of protecting native desert habitat.
- Livestock and livestock grazing leases are not permitted and trespass livestock are being prioritized for removal.
- Mining leases and any associated activities are not permitted at BMGR.

In 2012, a landscape-level habitat model was developed to identify locations where desert tortoise occupancy is most likely (Grandmaison et al. 2012). This knowledge, coupled with training maps, will allow range managers to identify specific locations where training and habitat overlap, and to take appropriate measures to reduce conflict to ensure their continued coexistence and compatibility with the military mission (Grandmaison et al. 2012). The model also serves as a valuable tool for prioritizing new areas to survey, including the Growler and Crater mountains, where there is a relatively high probability of tortoise occupancy (Grandmaison et al. 2012). The BMGR East 5-Year Work Plan includes surveying new areas and/or re-surveying known occupied and suitable habitat every five years, focused by model results.

7.4.3 Bats

To detect roost site locations and avoid potential conflicts between bats and the BMGR mission, several large-scale bat monitoring studies have occurred or are being implemented. A combination of survey methods are being used, including but not limited to acoustic monitoring, capture (i.e., mist netting), roost assessments, and guano sampling (Figure 7.5).

To better understand bat fauna at BMGR East, a large-scale monitoring study was implemented using a combination of roost, capture, and acoustic surveys (Mixan et al. 2016). By assessing bat diversity and habitat-use patterns, land managers will be able to better identify and address any potential population and range declines in bat species and act to mitigate or reverse those declines. A total of 17 species were identified in the survey (Table 7-1), including four species of concern: the cave myotis (*Myotis velifer*), California leaf-nosed bat (*Macrotus californicus*), greater mastiff bat (*Eumops perotis*), and Townsend's big-eared bat (*Corynorhinus townsendii*). From 2012–2014, a study was implemented to identify and avoid potential conflicts between bats and the military mission at BMGR East and West and at the nearby Yuma Proving Ground (Piorkowski et al. 2014). New data were collected and combined with data from previous studies, to identify potential bat roosts sites. It was determined that there is relatively little area across the BMGR where bats can rest, hibernate, and rear young. The loss of

Figure 7.5: Survey techniques use acoustic monitoring, mist netting, and roost assessments to monitor bats at BMGR.

traditional roosts, such as caves, has led to abandoned mines becoming increasingly crucial habitat features for roosting bats. This could create potential conflicts, as many of these abandoned mines exist in areas open for public recreation, where they represent a potential safety hazard. There are a number of methods (such as installing bat gates at mine entrances) that could prevent people from entering these areas while still allowing free passage for roosting bats.

The BMGR is committed to continually monitoring bat populations and evaluating and protecting important bat roost sites. Monitoring techniques that will be employed over the next 5 years—as time and funding allow—include continuing acoustic monitoring at known roost sites as well as re-analyzing old logs of bat calls by using new call detection software. The purpose of re-analyzing old call logs through improved call detection software is to determine whether the original call detection results were correct and whether any additional species may be present at certain roost locations (i.e., lesser long-nosed bats). Other planned monitoring objectives include continued mist netting and guano sampling and analysis. All data and results from these monitoring activities will be shared with partners at the USFWS and AGFD.

Table 7-1: Bat species detected at BMGR.

Common Name	Scientific Name
Big brown bat	*Eptesicus fuscus*
Brazilian free-tailed bat	*Tadarida brasiliensis*
California leaf-nosed bat	*Macrotus californicus*
California myotis	*Myotis californicus*
Canyon bat	*Parastrellus hesperus*
Cave myotis	*Myotis velifer*
Greater mastiff bat	*Eumops perotis*
Hoary bat	*Lasiurus cinereus*
Lesser long-nosed bat	*Leptonycteris yerbabuenae*
Little brown myotis	*Myotis lucifugus occultus*
Silver-haired bat	*Lasionycteris noctivgans*
Long-eared myotis	*Myotis evotis*
Pallid bat	*Antrozous pallidus*
Townsend's big-eared bat	*Corynorhinus townsendii*
Western red bat	*Lasiurus blossevillii*
Western small-footed myotis	*Myotis ciliolabrum*
Yuma myotis	*Myotis yumanensis*

7.4.3.1 Lesser Long-Nosed Bat

One lesser long-nosed bat has been detected at BMGR East. The post-delisting monitoring plan for the lesser long-nosed bat includes monitoring for potential roost occupancy and threats, and an assessment of forage availability through phenology and distribution of lesser long-nosed bat forage resources.

To provide data that will complement the lesser long-nosed bat post-delisting monitoring plan, the following activities may be implemented, as appropriate, on lands within the BMGR, as time and funding allow.

1. The USFWS and AGFD will be notified of any roost sites found to be occupied by lesser long-nosed bats through either the ongoing large-scale bat monitoring study (Mixan et al. 2016) or other monitoring actions.

2. The currently occupied lesser long-nosed bat roost will be monitored regularly and the data will be provided to the USFWS and AGFD. Research is encouraged to determine the occupancy and use patterns of this roost by lesser long-nosed bats.

3. In an effort to better understand occupancy and use patterns by the lesser long-nosed bat, a forage phenology monitoring site(s) may be established to track forage resources over time. This effort will follow protocols consistent with the U.S. National Phenology Network's ongoing program to monitor plant phenology across the U.S. The results will be added to the National Phenology Network system. Conducting forage phenology monitoring at the BMGR depends on time and funding availability.

7.4.4 Flat-Tailed Horned Lizard

BMGR West conducted extensive fieldwork on the FTHL from 2011 to 2014 (Goode and Parker 2015). The purpose of the study was to address two main issues identified by the USFWS and raised in the Biological Opinion: (1) potential impacts of jet noise on hearing and behavior of the FTHL, and (2) potential effects of increased vehicle traffic on roads in the vicinity of the KNOZ (USFWS 2010b). In 2012, a total of 499 FTHLs were removed from the KNOZ footprint. Twenty FTHLs were sent to the San Diego Zoo for a captive breeding program, and the remaining individuals were either translocated to mark-recapture plots or immediately moved to the other side of the exclusion fencing. During the course of the field work, 353 FTHLs were radio-tracked 7,561 times. It was determined that home range characteristics and movement patterns of non-translocated versus translocated lizards differed only in that translocated FTHLs had significantly larger home ranges in the season immediately following translocation. Although the survival rate of translocated FTHLs was lower than that of those that were not translocated, the difference was not statistically significant, and reproductive behavior was witnessed in both translocated and non-translocated individuals.

Figure 7.6: Baseline surveys for the FTHL provide valuable information for management of this species.

Over 22,000 miles were driven on paved roads at BMGR West while surveying for FTHLs. During that period, 412 live and 150 dead FTHLs were observed on the roadways. It was noted that avian predators were significantly more abundant along roads with power poles. Traffic from the KNOZ construction did not appear to have an effect on road mortality of FTHLs.

With funding provided by USMC and the Bureau of Reclamation, AGFD conducts annual occupancy and demographic surveys within the Yuma Desert Management Area to determine the population size, survival rate, recruitment, and population growth of FTHLs (Grimsley and Leavitt 2015). Approximately 88 percent of the management area is located within the BMGR West and the remainder is owned by the Bureau of Reclamation (Grimsley and Leavitt 2015). In 2008, AGFD established two 22-acre, long-term demography study plots, one within the BMGR West and the other on the Bureau of Reclamation parcel. In 2011, AGFD randomly selected 75 smaller (~328- x 656-foot) occupancy plots, a subsample of which is surveyed annually.

From 2008 to 2014, AGFD has captured 624 individual FTHLs within the two long-term, demography study plots (Grimsley and Leavitt 2015). Of the 624 captures, 316 were juveniles and 308 were adults (Grimsley and Leavitt 2015). There was a high variability in the number of juveniles captured over the 7-year study period.

From 2011 to 2014, FTHLs were detected during 43 of 82 (52.4 percent) occupancy surveys and in 21 of 29 plots (72 percent) (Grimsley and Leavitt 2015). Of the individuals captured, 21 were male and 22 female (Grimsley and Leavitt 2015).

7.4.5 Acuña Cactus

In 2013, the acuña cactus was designated as a federally endangered species. It is also protected by the Arizona Native Plant Law and is designated as a highly safeguarded native plant. On 19 September 2016, the USFWS designated critical habitat for the acuña cactus. The critical habitat includes six geographically separate units totaling approximately 18,535 acres. One unit is adjacent to the northeastern portion of the BMGR East; however, lands within the BMGR are exempt from critical habitat designation. At least three distinct clusters of an acuña cactus exist in the BMGR East (Urreiztieta 2013, Abbate 2017). The plant has not been detected in the BMGR West, nor is it expected to occur.

The BMGR East has developed an Inventory and Monitoring Plan, utilizing the same protocols implemented at Organ Pipe Cactus NM, for monitoring the acuña cactus (56 RMO 2007). This protocol is designed to assess population dynamics of the acuña cactus by monitoring growth, mortality, recruitment, and reproductive status of any populations that occur at BMGR East. Currently, the protocol for monitoring the cactus calls for surveying once every five years, beginning in mid-March and continuing once per week for the remainder of the flowering period. Since the recent change in federal status of the acuña cactus, it is likely that the 56 RMO will consult with USFWS to verify that monitoring and conservation actions are appropriate for the species.

Data on locations of individual plants will be used to further define the habitat conditions most suitable to the species, including drained knolls and gravel ridges between major washes and on hilltops in granite substrates. Models of areas with suitable habitat will be used to identify areas to

survey and monitor. Data from the monitoring will be compiled into reports on an annual basis, and analyzed to determine trends for the species, which may lead to implementation of adaptive management actions, such as road closures or fire-suppression activities (56 RMO 2007). The annual reports will be shared with the AGFD's Heritage Data Management System, and it is anticipated that there will be annual meetings of all natural resource management agencies to discuss species trends. Additionally, wildlife biologists at the 56 RMO have been communicating with the AGFD to identify possible additional survey locations within the BMGR East.

In addition to conducting surveys of habitat area, other conservation measures will be taken to minimize the potential for disturbance of acuña cactus and its habitat. These actions include monitoring and controlling invasive species; developing and implementing a fire management plan (to include assessing fire risk and maintaining a firefighting agreement with BLM); developing and implementing procedures to control trespass livestock; monitoring illegal immigration, contraband trafficking, and border-related law enforcement; and continuing informal coordination with law enforcement authorities. Controlling invasive species helps to maintain quality habitat and prevent unnatural fire.

Mining and agriculture are prohibited within the BMGR, thus eliminating these threats to acuña cactus. It is believed that the acuña cactus and its habitat are protected from disturbance by the rugged terrain and hilltop locations where it occurs at BMGR.

The USAF agrees to continue its protection of acuña cactus habitat. It will prevent new impacts, such as establishing new military targets and off-road vehicle use, in the proposed critical habitat area; avoid disturbing vegetation and pollinators within 2,952 feet (900 meters) of known or newly discovered acuña cactus plants; and continue to monitor and control invasive plant species. Detailed vegetation mapping will be completed by FY 2019 for BMGR East, and these data might contribute to more precise acuña cactus habitat modeling efforts. Furthermore, when resources are available, the USAF may aid in or enable with ex situ conservation efforts to establish new populations of acuña cactus on BMGR and other areas as appropriate.

Although a recent study has shown that the acuña cactus population at BMGR East has increased by roughly three percent, there are still a number of recommendations that should be followed to ensure its numbers continue to rise (Abbate 2017).

- Continue to monitor acuña cactus populations and morphological measurements for individuals within new populations.
- Monitoring efforts will focus on ridges, hillsides, and gentle slopes where the cacti are most likely to be located.
- Fencing off areas where cactus populations are most vulnerable to being crushed or uprooted due to animal movement and grazing should be considered. Wildlife-friendly fencing should be used and placed to minimize disruption to the movement of native wildlife.
- Initiate seed collection and captive propagation trials.
- Use wildlife game cameras to document predation, potential unknown threats, and seed dispersal mechanisms.

- Future research teams should be limited to two individuals to restrict damage to small acuña cacti, which are vulnerable to crushing and uprooting.

7.4.5.1 Climate Impacts on acuña cactus

The acuña cactus is highly vulnerable to climate change. Climate change is one of the primary threats to the acuña cactus due to increasing drought frequency and intensity and altered precipitation patterns (USFWS 2013). Prolonged drought within the Sonoran Desert has already affected populations negatively though reduced seed recruitment and adult survivorship (USFWS 2013) and by shifting flowering phenology (Bowers 2017). See Threatened and Endangered Species Appendix of the CSU CEMML climate change report for more information.

7.4.6 Migratory Birds and Eagles

7.4.6.1 Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918 (MBTA) is a federal statute that implements four treaties with the U.S. and Canada, Mexico, Japan, and Russia on the conservation and protection of migratory birds. More than 800 species of birds are protected by the MBTA (50 CFR 10.13). The MTBA prohibits the taking, killing, or possessing of migratory birds unless permitted by regulation. In 2003, the National Defense Authorization Act directed the Secretary of the Interior to exercise their authority under the MBTA to prescribe regulations exempting the Armed Forces from incidental take during military readiness activities authorized by the Secretary of Defense. Effective 30 March 2007, the USFWS issued a Final Rule authorizing the take of migratory birds as a result of military readiness activities, provided such activities do not have a significant adverse effect on the population (USFWS 2007).

Executive Order 13186 (EO 13186) directs agencies to take certain actions to further strengthen migratory bird conservation under the conventions under the MBTA, the Bald and Golden Eagle Protection Act (BGEPA), and other pertinent statutes. It requires the establishment of MOUs between the USFWS and other federal agencies. Accordingly, DoD and USFWS signed an MOU in 2006 to promote the conservation of migratory birds (DoD and USFWS 2006). This MOU, which was updated and re-signed in 2014 (DoD and USFWS 2014), describes specific actions that should be taken by DoD to advance migratory bird conservation; avoid or minimize the take of migratory birds; and ensure that DoD operations, other than military readiness activities, are consistent with the MBTA.

The EIS F-35A Training Basing Mitigation Plan for Luke AFB (USAF Air Education and Training Command 2013) also addresses migratory bird protection. The plan stipulates that, in the military training airspace: (1) existing flight restrictions concerning altitude and offset distances from sensitive species will be adhered to strictly, and (2) the quarter statute mile overflight avoidance of Mexican spotted owl activity centers will be maintained, (as stated via informal consultation with the USFWS; note, this buffer distance was later modified as described below). The plan also stipulates that an open dialogue will continue between 56 RMO Airspace Managers and Environmental Science staff to: (1) ensure compliance with biological opinions and identify/address any emerging issues associated with airspace use, and (2) ensure that protected owl-activity centers are charted and avoidances are described on in-flight guides for military training routes, respectively. Continued monitoring/recording/tracking of deviations and noise complaints and communicate reported

deviations with appropriate offices. In 2013, 56 RMO requested and USFWS concurred (see USFWS letter dated 23 Dec 2013) with a proposal to reduce the radial distance of the avoidance buffer around Mexican spotted owl activity centers underlying military training routes from 1,320 feet (0.25 mile) to 500 feet.

From 2012 to 2014, AGFD completed a breeding bird survey. Most species of birds found at the BMGR fall under MBTA protection. MCAS Yuma and Luke AFB have prepared a bird check list that is provided to visitors if requested. The list identifies species that may be sighted; the species list is extensive and is not repeated in this document.

7.4.6.2 Bald and Golden Eagles

Since the 1990s when the bald eagle was listed under the ESA, pilots of military aircraft flown or managed by the 56 FW observe a 1-nautical-mile lateral separation around bald eagle breeding areas during the breeding season (December 1–July 15), in accordance with measures described in a 1994 biological opinion. Luke AFB also has been a committee member of the Southwestern Bald Eagle Management Committee since at least the 1990s and, in 2007, the 56 FW became an MOU signatory to the Conservation Assessment and Strategy for the Bald Eagle in Arizona.

After the bald eagle was delisted on 28 June 2007 and the 1994 biological opinion was no longer in effect, eagles nonetheless remained protected by the MBTA and the BGEPA. In 2013, the 56 RMO, with technical assistance from USFWS and AGFD, implemented two changes to the avoidance buffers around bald eagle breeding areas. First, the avoidance buffer during the breeding season was changed from 1–nautical-mile of lateral separation to 2,000 feet of lateral and vertical separation. Second, the breeding season is now observed from December 1 to June 30, in accordance with a 2006 Conservation Assessment, which was renewed in 2014. Because the bald eagle breeding window has been found recently at specific locations to extend past June 30 (especially at higher elevations where nesting is initiated later in the spring), further evaluation and information may warrant consideration in altering this window for specific nesting sites.

Less is known about the avoidance measures needed for golden eagles that may be affected by military training activities. This lack of knowledge and updates to the BGEPA have increased the need for golden eagle nest monitoring in the southwestern desert region. In 2011, the Southwestern Golden Eagle Management Committee was formed and the 56 FW became a participant on that committee.

Beginning in 2006, AGFD began to investigate breeding golden eagle statewide distribution and status, which led to an improved understanding and the current ongoing monitoring effort (McCarty et al. 2017). In 2006, AGFD surveyed 85 previously known breeding areas (BAs), finding 14 were occupied by golden eagles (McCarty et al. 2017). From 2011 to 2014, the Department conducted statewide aerial occupancy and nest survey efforts for cliff-nesting golden eagles (McCarty et al. 2017). Building upon these survey results, the AGFD began assessing productivity at a subsample of known BAs in 2015 and 2016 (McCarty et al. 2017). After the 2017 season, there were 275 known golden eagle BAs, 46 historic BAs, and 474 potential BAs outside of Native American lands in Arizona.

The DOD also contracted with AGFD to design and implement a three-year study (2013–2015) evaluating possible impacts to golden eagles from airborne military training activities and compliance with BGEPA. The study has three primary objectives: (1) identify and survey the potential distribution of golden eagle breeding areas across military lands, (2) create a landscape-scale model to predict the likelihood of potential golden eagle nesting habitat, and (3) collect golden eagle demographic information and provide management recommendations that will permit BMGR and other southwestern military installations to maintain their training regimes while also complying with the BGEPA (Piorkowski et al. 2015).

The following actions were recommended for implementation.

- Continue monitoring known, potential, and historic golden eagle nests on military installations.
- Coordinate with local, state, and regional authorities on current golden eagle distribution and status to inform current and future military activities for compliance with BGEPA.
- Develop avoidance buffers around known golden eagle nests during the breeding season, specifically those that were occupied within the last five years.
- Avoid disturbance around potential and historic golden eagle nests during the early (pre-incubation, incubation, and nests with nestlings <4 weeks of age) breeding season. Potential nest sites are described as those that provide suitable nest-site structure but where no golden eagles have been previously observed. Historic nests are sites that were used by golden eagles in the past, but have had no occupancy for the most recent decade. Normal military training activities can resume in the area once all potential or historic nests have been deemed unoccupied for a given breeding season.
- Avoid heavy ground and aerial disturbance during the early breeding season within habitat predicted by the habitat model as having a high likelihood of being potential golden eagle nesting habitat. By using precise modeling, reducing heavy disturbance activities in areas of high likelihood may reduce or eliminate incidental take even if surveys to document nesting golden eagles have not been completed in those areas. Future model validation should allow quantification of thresholds associated with high likelihood habitat in the modeled estimates.

There is a current effort underway (via contract between USAF and the Colorado State University's Center for Environmental Management of Military Lands) to compile and standardize all historical locations of eagle nests and associated data for a subset of Air Force installations in the western U.S., including Luke AFB and BMGR. All nest locations recorded on installations after project completion should be shared with the AGFD. Likewise, periodically BMGR and Luke AFB will request all eagle nest data recorded by AGFD within the military operating area. The project products will include recommendations for compliance with BGEPA, including monitoring eagle populations, behaviors, and productivity; mitigating disturbance; and assessing the risks associated with overhead utility infrastructure. Meanwhile, the 56 FW observes the same buffer parameters for golden eagle nests as it does for bald eagle nests (territories occupied within the most recent decade): 2,000 feet of lateral and vertical separation from December 1 to June 30. As new information about sensitive areas is acquired, it will be provided to the 56 RMO Airspace Manager, who updates the GIS layers with the new data, displays all the sensitive species areas on maps, and shares the maps with trainees so that these sensitive areas may be avoided during crucial times and/or seasons.

In February and March 2020, AGFD performed an Air Force-funded Golden Eagle nest occupancy survey of the BMGR East. The survey was conducted by helicopter and included two full searches (one in February and another in March) of all potential nesting habitat. During the survey, five active breeding areas were discovered. The breeding areas were found within the following mountain ranges: one in Aguilas, one in southern Mohawks, one in Sand Tanks, and two in the Saucedas. Following this discovery, the 56 FW stood-up a seasonal 2,000 foot aircraft avoidance buffer around each breeding area.

7.4.7 Monarch Butterfly

Monarch butterfly (*Danaus plexippus*) larvae are obligate consumers of native milkweeds (*Asclepias spp.*); thus, the adults need milkweed plants on which to lay their eggs (Morris at al. 2015). Because no milkweeds grow at BMGR, monarch breeding at the installation is unlikely; however, the low-elevation desert ecosystems at BMGR are part of an important monarch butterfly migration route. A small number of butterflies also overwinter in these habitats during mild winters (Morris et al. 2015). Important habitat-management practices for monarch butterflies at BMGR include any that protect natural migration and overwintering habitats from anthropogenic disturbances. Specific management actions already in place at BMGR are listed below.

- Regulating off-road recreation
- Restricting ground-disturbing activities in focused ground-support areas
- Adhering to NEPA processes for ongoing and new activities
- Limiting development
- Interagency collaboration through the BEC and the IEC
- The presence of four full-time CLEOs who enforce regulations

7.4.8 Climate Impacts on Threatened and Endangered Species Management

The effectiveness of management actions taken to protect threatened and endangered species will depend on the speed at which the climate changes, the nature of the climatic changes, and the ability of each species to respond to those changes. Our understanding of organism responses to a changing climate is not yet sufficient to be able to predict how an individual species will respond. In addition, the response of sub-populations of a single species may vary. For example, genetic variation within a species can aid adaptation to changing environmental conditions, but populations may not be able to undergo selection for preferred traits if environmental conditions change too rapidly (Hoffmann and Sgrò 2011). Behavioral changes (e.g., host-plant or food source switching) and phenotypical responses (e.g., changes in body size associated with longer growing seasons) have already been observed in some organisms (Ozgul et al. 2010; Iwamura et al. 2013).

Many current management activities for threatened or endangered species are appropriate for increasing species' resilience or facilitating adaptation to climate change. An ecosystem approach that prioritizes functional diversity, maintenance of habitats, habitat variability, and habitat connectivity will potentially help species adapt to changing conditions or migrate to more favorable

habitats. However, when approaching the uncertainty that is inherent with managing species under changing environmental conditions, additional analysis and planning is required.

Historic patterns used for management decisions are likely to be insufficient for future management challenges (Bierbaum et al. 2013). Proactive approaches that anticipate change can help extend the period over which species can adapt to changing climate and avoid catastrophic declines associated with stochastic events that act on an already stressed ecosystem (CEMML 2019).

7.5 Water Resource Protection

Surface water availability is so limited at BMGR during certain times of the year that the AGFD began developing wildlife watering sites in the late 1950s. *Playa*s, *tinajas*, and other natural water resources, which are important to migratory birds and other wildlife, were often modified to extend the availability of water in them to benefit wildlife. AGFD has constructed catchments at locations across BMGR to collect and store rainfall. Currently, over 40 wildlife watering sites are maintained across the range through a partnership between the 56 RMO, MCAS Yuma RMD, and the AGFD. During periods of extreme drought, AGFD will routinely refill these water sources by hauling in tens of thousands of gallons annually, by both truck and helicopter, to support wildlife species. These sites are also being used and affected by illegal immigrants and drug traffickers (Figure 7.7) across the range.

Figure 7.7: Camera traps capture wildlife watering sites being used by UDAs.

BMGR East

Researchers from Texas Tech University who are conducting amphibian research at BMGR detected elevated levels of ammonium (NH_3) at several wildlife watering sites. This prompted the USGS to evaluate the water quality at a variety of different wildlife watering sites across the BMGR, including natural and modified *tinajas* and artificial water catchments. Sampling began in 2013 and has continued each year since (USGS 2013–2016). The water is tested for a variety of chemical parameters, blue-green algae (cyanobacteria), and chytrid fungus (*Batrachochytrium dendrobatidis*).

Results of the water quality analysis have varied over the 4 years of sampling. Ammonia concentrations at a number of sites have occasionally exceeded the Arizona Department of

Environmental Quality's acute and/or chronic standards for aquatic life and wildlife (Arizona Department of Environmental Quality 2009; USGS 2013–2016). In 2015, the iron (Fe) concentrations at wildlife watering site 1148 exceeded the EPA-recommended freshwater criterion for aquatic life (USGS 2013–2016). Blue-green algae concentrations were below the detection limits for microcystin, cylindrospermopsin, and saxitoxin. Several wildlife watering sites tested positive for chytrid fungus in 2013, 2014, and 2016 (USGS 2013–2016), although the majority of positive samples were below the detection limit (USGS 2013–2016).

A concern among tribal cultural experts and archaeologists is the modification of natural water sources—*tinajas*—to create more reliable water sources for wildlife (56 RMO 2009). Water has always been a critical resource to desert dwellers and travelers; thus, archaeological evidence is often concentrated around natural water resources. Modifications and ongoing maintenance could result in damage or destruction to these traditionally significant resources.

The tribes would like to have the enhancements and modifications removed and, to the extent possible, have the *tinajas* restored to a natural state. The USAF is working with the tribes and AGFD to remove the structures and has prohibited any alterations of existing structures at *tinajas.* Only construction and remodeling of existing artificial wildlife watering sites is permitted.

Over the next five-year planning period, the BMGR East will continue a holistic review based on previous studies and relevant literature to evaluate the benefits and adverse effects of wildlife watering sites, continue water quality monitoring, develop recommendations for management and support AGFD annual maintenance and redevelopment of all existing water development as required.

BMGR West

The BMGR West will continue to work with AGFD to monitor and maintain the existing wildlife watering site network over the next five-year period covered by this INRMP.

7.6 Wetland Protection

There are no jurisdictional wetlands regulated under the USACE, 404 Clean Water Act Program.

7.7 Grounds Maintenance

The BMGR does not support or require ground maintenance activities. Minimal ground maintenance activities do occur at the Gila Bend AFAF, where there are several small turf areas and several rows of planted trees. Gila Bend AFAF is operated and maintained by a USAF Contractor and all ground maintenance activities are completed by the contractor or sub-contractor as part of the service contract agreement. The total area of Gila Bend AFAF is 2,011 acres with less than 7 acres requiring ground maintenance.

7.8 Forest Management

The entirety of the BMGR lies within the Sonoran Basin and Range Level III Ecoregion. Very few trees are able to survive in this ecosystem given the harsh, hyper-arid (less than 4 inches of precipitation annually) desert climate. No commercial forests occur within the range boundary.

7.9 Wildland Fire Management

Until the early 2000s, wildfires larger than a few acres in size were almost unknown in the Sonoran Desert. The natural fire-rotation interval for portions of the Sonoran Desert, including the BMGR, was estimated to be 274 years (Schmid and Rogers 1988). The low densities of native vegetation typically did not provide sufficient fuel to carry fires over large areas. Sonoran Desert vegetation is typically not fire-tolerant, and large fires within these vegetation communities have the potential to significantly alter vegetation composition at the ecosystem or landscape level. Desert vegetation, such as saguaro cactus, organ pipe cactus (*Stenocereus thurberi*), blue paloverde, ocotillo, and creosote bush are very susceptible to fire and may take decades to re-establish.

Figure 7.8: Wildfire at BMGR East.

The spread of non-native, invasive plants has altered the natural fire regime in some areas. Historically, bare space between shrubs and trees limited the extent that fires could spread in the Sonoran Desert, but changes in climate, human activities, and the resulting spread of invasive species are leading to increased fuel loads, changing fuel characteristics, and putting some fire-intolerant native species at risk. Introduced grasses and forbs increase fuel continuity across the landscape, altering vegetation composition and promoting larger fires and greater fire frequency and intensity (Geiger and McPherson 2005). This, coupled with the tendency of many invasive species to be the first species to recover post-fire (often at greater than pre-fire densities and coverage), leads to a positive feedback loop. Under this scenario, increasing density and cover of invasive species lead to increased fire activity, which in turn favors increased density and cover of those species, which then leads to even greater fire frequency and size. The end result of this potential scenario is a truly altered fire regime and vegetation community across the landscape.

In 2008 or 2009, a wildfire at BMGR West that was evidently fueled by Sahara mustard burned approximately 500 acres of native creosote-bursage community. Post-fire field inventory showed that the mustard was the only species recovering in that area (Malusa 2010), indicating that the vegetation community may be changing over time (which may be driving a change in fire regime). This trend places a priority on continuous invasive species management to protect the quality of the range for native plants and wildlife and to ensure that there will be no impact to the military training activities and mission readiness.

Figure 7.9: Fire scar on saguaro cactus at BMGR East.

BMGR East

The 2012 INRMP revision reported a total of 87 wildfires recorded from 2006–2011. All fires were small and typically located within target complexes. Three grass fires along SR 85, likely started by passing vehicles, were each about 1/10 acre in size. It was reported that, in general, invasive plants did not play a critical role in the spread of many of these fires. Wildfires in 2005, however, did burn approximately 132,000 acres of the BMGR East, requiring emergency intervention from the National Interagency Fire Center. The 2005 fire season was considered an anomaly due to the heavy winter rains that lead to increased fuel loading of native vegetation. It is also likely that the spread of invasive species may have contributed to the fuel load available to carry these fires.

Since 2011, there have been 126 fires ranging in size from a few square yards to several hundred acres. These fires are reported to and investigated by the 56 RMO Wildland Fire Program Manager. An account of each incident is reported and stored in the 56 RMO BMGR East Fire History Spreadsheet.

The 56 RMO is working to finalize the WFMP. The plan will define roles and responsibilities and provide guidance for the offices, departments, and agencies involved and will describe pre-fire suppression and suppression actions to be taken on a strategic as well as a tactical basis (56 RMO 2014). The document will serve as the guiding plan for wildfire response protocols. The Air Force Wildland Fire Center developed a revised WFMP template in the fall of 2019, after the first round of WFMP deliverables. The BMGR East WFMP was one of the first plans developed and was lacking multiple sections identified in the revised Air Force WFMP template.

A contracting firm selected by the Air Force Wildland Fire Center plans to begin incorporating missing sections to the BMGR East FMP October 2020. The plan is expected to be finalized at the beginning of 2021.

As part of this WFMP development process, the 56 RMO also signed an MOU with the BLM for fire suppression assistance on BMGR East (DOI and USAF 2020). The purpose of the MOU is to clarify existing policies for response to wildland fires at BMGR East, to establish procedures and guidelines for cooperation between the parties to ensure BLM response, and to provide BLM assistance with

wildland fire emergencies occurring on those lands. Through interagency cooperation and partnership for the management of BMGR East, the parties agree there is mutual interest in a cooperative response to wildland fires that may affect lands within and outside BMGR East boundaries. The 56 RMO will notify BLM of all wildfires located within two miles of any shared border and BLM assistance for the suppression of wildland fires on BMGR East will be on a case-by-case basis.

The Air Force Wildland Fire Center has initiated the Wildland Fire Regional Support Program. This national program of Wildland Support Modules (WSMs) staffed by USFWS and BLM wildland fire personnel to provide wildland fire support at USAF installations to include prescribed burning, mechanical fuels reduction activities for ecosystem management and mitigation of wildfire as a threat to the ecosystem, mission activities, and military readiness. The WSM possesses the qualifications to supplement and support on-installation wildfire suppression activity if requested and available. Within the west region, Nellis AFB serves as the WSM base installation encompassing Nellis AFB, Luke AFB, BMGR East and Davis Monthan AFB.

The BLM Module Lead has taken over the BMGR East long-term fire repeat photography project. 56 RMO Wildlife Biologist initiated the fire repeat photography photo plots within a burned area in 2006. The project grew to include many more photo points, cardinal directions and control points. The project monitoring frequency is every 5th year; however, BLM is going to visit a subset of the photo points annually. Using repeat photography to monitor environmental change following a wildland fire may provide patterns of post-fire environmental change, particularly recovery and mortality of vegetation and soil disturbance.

BMGR West

There have been very few wildfires at BMGR West. Overall, wildfire risk is much lower at BMGR West than it is at BMGR East, largely due to the difference in precipitation patterns that support only minimal vegetation growth at BMGR West. Even with this lower risk, however, MCAS Yuma is required to develop and implement a WFMP, per MCO 5090.2 (USMC 2018). The WFMP will define roles and responsibilities for offices, departments, and agencies involved in pre-wildfire suppression and suppression activities, and it will provide guidance for firefighters, public safety officials, and the RMD to maximize military training operations prior to and during a wildland fire event. Once the WFMP is complete, the MCAS Yuma RMD intends to develop a MOU with the BLM for fire suppression assistance at BMGR West.

7.9.1 Climate Impacts on Wildfire Management at BMGR East and West

The greatest impacts of climate change on wildfire activity at the range will be via changes in vegetation. Invasive species, including fire-adapted grasses and annuals, have invaded many parts of the Sonoran Desert. Wherever those species become common, fires are likely to become larger and much more frequent. This creates a cycle that is distinct from the current very low fire frequency regime of the desert. Precise estimation of invasive plant extent and intensity was beyond the scope of the CSU CEMML study, so the below analysis assumes the absence of large-scale grass or annual invasion (CEMML 2019).

Wildfires in the Sonoran Desert are generally limited by fuel continuity more than any other single factor. The desert is typically dry enough to support combustion and ignition sources on a live-fire military range are frequent and widespread. However, much of the land area is too sparsely vegetated to support fire growth, and those fires that happen to occur in patches of fuels are isolated and rarely grow larger than a few acres. Though fires may occur, the acreage of any individual fire, or fires in aggregate, is generally quite small.

There are rare occasions when unusually abundant winter rainfall produces a flush of vegetation that may support more robust fire activity, as occurred in the winter of 2004 – 2005 and led to some of the largest fires on record in the Sonoran Desert in the summer of 2005. The increased overall precipitation predicted in climate models indicates a greater likelihood of high winter rainfall events, which may lead to a slightly higher likelihood of fire seasons like 2005.

7.10 Agricultural Outleasing

No agricultural outleasing programs at BMGR.

7.11 Integrated Pest Management Program

The Federal Insecticide, Fungicide, and Rodenticide Act of 1996 (FIFRA) provides for federal regulation of pesticide distribution, sale, and use (7 U.S.C. § 136 et seq.). All pesticides distributed or sold in the U.S. must be registered (licensed) by the EPA. Before the EPA may register a pesticide under FIFRA, the applicant must show, among other things, that using the pesticide according to specifications "will not generally cause unreasonable adverse effects on the environment.''

FIFRA defines the term ''unreasonable adverse effects on the environment'' to mean ''(1) any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide; or (2) a human dietary risk from residues that result from a use of a pesticide in or on any food inconsistent with the standard under section 408 of the Federal Food, Drug, and Cosmetic Act.''

Rules, EOs, and regulations applicable to integrated pest management are listed below.

- EO 13751, December 2016, Safeguarding the Nation From the Impacts of Invasive Species (EO 13751 2016)
- EO 11987, May 1977, *Exotic Organisms* (EO 11987 1977)
- DoD Directive 4715.1, February 1996, *Environmental Security* (DoD 1996b)
- DoD Instruction 4715.03, May 1996, *Environmental Conservation Program*
- DoD Regulation 4150.7-P, September 1996, DoD Plan for the Certification of Pesticide Applicators (DoD 1996a)
- AFMAN 32-1053, September 2019, *Integrated Pest Management Program* (USAF 2019)
- Office of the Chief of Naval Operations Instruction 5090.1B, with changes 1-4, *Environmental and Natural Resources Program Manual* (USN 2003)
- MCO 5090.2, June 2018, *Environmental Compliance and Protection Program* (USMC 2018)

DoD Directive 4715.1 provides policies and procedures to establish and maintain safe, effective, and environmentally sound integrated pest management programs to prevent or control pests and disease vectors that may adversely impact readiness or military operations by affecting the health of personnel or damaging structures, material, or property. It also ensures that pest management programs achieve, maintain, and monitor compliance with all applicable EOs and Federal, State, and local statutory and regulatory requirements. The pest management programs incorporate sustainable philosophy, strategies, and techniques in all aspects of DoD and contractor vector control and pest management planning, training, and operations, including installation pest management plans and other written guidance to reduce negative effects of pesticides.

7.11.1 Invasive Plants

In accordance with the management goals provided by the 2012 BMGR INRMP, vegetation inventory and monitoring plans have been developed and implemented for both the BMGR East (56 RMO 2007) and BMGR West (Villarreal et al. 2011). These plans adopted several protocols from existing regional vegetation monitoring programs, allowing for the integration, collaboration, and sharing of both BMGR East and West monitoring efforts with surrounding land management agencies. As part of these vegetation monitoring efforts, a majority of the range has now been inventoried and mapped according to a standardized approach that has been used across the various adjacent federal lands (USFWS, BLM, and NPS). While the vegetation community mapping is largely complete, inventory and monitoring efforts will continue over the next several years to establish quantifiable trends in vegetation communities over time.

One of the issues that will be identified in the ongoing vegetation inventory and monitoring efforts is how the spread of exotic, invasive, or noxious plants impact native Sonoran Desert vegetation communities. Exotic species, as defined in DoD Instruction 4715. 03, are "species that occur in a given place, area, or region as the result of direct or indirect, deliberate or accidental introduction of the species by human activity." EO 13751 (EO 13751 2016) requires federal agencies to identify actions that may affect invasive species; use relevant programs to prevent introduction of invasive species; detect, respond, and control such species; monitor invasive species populations; provide for restoration of native species; conduct research on invasive species; and promote public education. An invasive species, as defined in EO 13751, is a "non-native organism whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health (EO 13751 2016)"

Exotic, invasive, or noxious plants are characterized by (1) their ability to easily colonize disturbed areas and (2) specialized dispersal mechanisms that allow them to quickly become the dominant vegetation in an area. These abilities differ between species, but invasive plants generally have the potential to impact native vegetation communities. Roads, livestock, and people, serve as the primary vectors for invasive species at BMGR. The 2007 INRMP reported that the density and distribution of non-native species was not accurately known, although BMGR East was estimated to have a comparatively greater distribution of invasive species than BMGR West due to its greater annual rainfall amounts and closer proximity to vector sources for invasive species. Several studies and mapping efforts have been undertaken since the 2012 INRMP revision to better understand the

distribution, density, and life history of invasive species at BMGR (e.g., Li and Malusa 2014; Damery-Weston 2016; also, the BMGR West GIS Cloud Mapping Effort).

Sahara mustard (*Brassica tournefortii*)

Figure 7.10: Sahara mustard at BMGR.

Sahara mustard (Figure 7.10) is a cool-season, winter annual herb that flowers early in the year (December–February) with small, dull-yellow flowers that make them inconspicuous compared to most other true mustards (Bossard et al. 2000). A single large plant can produce up to 16,000 seeds. Dried plants tend to break off near the soil surface and then tumble across the landscape like Russian thistle, spreading seeds along the way. According to Bossard et al. (2000), Sahara mustard was first recorded in the late 1920s in the Coachella Valley of California. In 1957, the species was found near Yuma, AZ, and had become widespread by the 1970s. Due to its early growth/flowering phenology, Sahara mustard is able to capitalize on winter soil moisture early in the growing season, allowing the species to largely complete its lifecycle prior to when many native species begin to flower (Bossard et al. 2000).

Given the species' affinity for sandy soils and its life history, Sahara mustard continues as the most prevalent invasive species at BMGR. The spread of this species is a greater concern at BMGR West because the soils there are generally sandier. Habitat type, species competition, and other biotic and abiotic factors are likely to have a substantial influence on the spread of this species. Sahara mustard tends to produce a dense, highly flammable, monoculture ground cover. As such, it can reduce native plant diversity and increase fire risks. Also, given that Sonoran Desert plant communities are not fire-adapted, greater frequencies of wildfire have potentially devastating results.

Buffelgrass (*Pennisetum ciliare*, Syn. *Cenchrus ciliaris*)

Figure 7.11: Buffelgrass outbreak within Area B.

Listed as a State of Arizona Prohibited and Regulated Noxious Weed (Arizona Administrative Code 3-4-244), buffelgrass (Figure 7.11) is native to the arid and semi-arid regions of East Africa, the Arabian Peninsula, Madagascar, Pakistan, and northern India (Cox et al. 1988). It arrived in Australia in 1880 and in Texas in 1917. The species was first introduced into the U.S., South America, and Mexico as a means to improve productivity of grazing pastures

and to provide for erosion control (California Invasive Plant Council 2006). Across the region, buffelgrass is spreading rapidly, and, where it becomes established, it often displaces native vegetation and forms a dense monoculture. Buffelgrass has the potential to alter the natural Sonoran Desert fire regime, further impacting and displacing fire-intolerant communities of native vegetation (McDonald and McPherson 2011; U.S. Forest Service 2014). Buffelgrass is found across the BMGR, and recent research by Whittle and Black (2014) and Damery-Weston (2016) has provided insight into the rate of buffelgrass expansion for areas at BMGR East along SR 85.

Fountain Grass (*Pennisetum setaceum*)

Fountain grass (Figure 7.12) is a coarse perennial grass with a densely clumped growth form that can reach five feet in height (Bossard et al. 2000). Originally native to Africa and the Middle East (Williams et al. 1995), fountain grass has been introduced to many areas in the U.S. and other parts of the world due, in part, to its popularity as an ornamental plant (Neal and Senesac 1991; Williams et al. 1995). Its seeds are easily dispersed by vehicles, humans, livestock, wildlife, wind, and water (Cuddihy et al. 1988; Tunison 1992; Bossard et al. 2000). Fountain grass is found in areas on BMGR East and West and, similar to buffelgrass and Sahara mustard, its fire-tolerant nature could lead to altered fire regimes if these species are left unmanaged (California Invasive Plant Council 2006).

Figure 7.12: Fountain grass infestation. Photo courtesy of NPS.

Mediterranean grass (*Schismus arabicus* and *S. barbatus*)

Mediterranean grass is native to Eurasia (Jackson 1985). The species was introduced into North America, South America, Australia, and the west coast of Europe where Mediterranean climate regimes occur (Bor 1968). In North America, it likely spread westward from Arizona into California during the early 1900s (Burgess et al. 1991). It was first recorded in California in 1935 (Robbins 1940) and is now well established in the southwestern U.S.

Colocynth (*Citrullus colocynthis*)

Colocynth (Figure 7.13), or desert gourd, is an invasive desert melon that thrives in sandy, arid soils. Its deep tap root provides access to moisture, allowing it to outcompete native vegetation (Burrows and Shaik 2015). Native to the Mediterranean, Middle East, and Asia, colocynth has become widely invasive across portions of Australia (Shaik et al. 2015) and has recently been found in the U.S. within Death Valley National Park (Swearingen 2008). A small population was recently found adjacent to the Range 1 access road at BMGR East in close proximity to an active archeological excavation (Fox 2017). It is believed that colocynth seeds were potentially brought in on excavation equipment being used for the archeological operation. All identified plants and fruits were pulled and disposed of, although there was evidence of broken and partially eaten fruit, indicating seed dispersal may have occurred (Sheri Fox, pers. comm., 2017). In June 2019, about 60 plants were found growing again

along the Range 1 access road and smaller numbers were found growing in NTAC and STAC. This discovery was followed-up by hand-removal of mature fruits and herbicide treatment of growing plants in early July 2019. 56 RMO staff will continue to monitor the surrounding area and attempt to limit the spread of this invasive species.

Figure 7.13: Colocynth plants (left), flower (middle), and fruits (right). Photos courtesy of Qatar Natural History Group.

7.11.1.1 Other Invasive Plants

Other non-native species that have been identified at BMGR include Lehmann lovegrass (*Eragrostis lehmanniana*), salt cedar (*Tamarix ramosissima*), Athel tamarisk (*Tamarix aphylla*), Russian thistle (*Salsola tragus*) and red brome (*Bromus rubens*). If left undetected, unmonitored, and unmanaged, nonnative invasive species could fundamentally alter the BMGR's ecosystem structure through competition with native species, reduction of species diversity, and enhancing the spread of wildfires (Villarreal et al. 2011).

7.11.1.2 Spread of Invasive Plants

Roads

Roads have been identified as a major contributor to the spread of invasive plants at BMGR (Figure 7.14), and the proliferation of new roads and subsequent increases in soil disturbance is of particular concern to range managers. Seeds from invasive species can be caught in wheel wells, undercarriages, and tire treads as vehicles drive through infested areas. As vehicles travel into uninfested areas, seeds may fall out, thereby effectively dispersing invasive species seeds into a new area. Additionally, roads often create favorable germination and growing conditions for invasive species by altering drainage patterns, catching additional water, disturbing the soil, and burying the invasive species seeds (particularly when drag road surfaces are smoothed). In recent years, increased activities related to geocaching, BP use, and illegal humanitarian aid drops have led to increased off-road vehicle use in some areas. This increased use has heightened the risk for resource damage and

Figure 7.14: Buffelgrass infestation along SR 85.

increased the chances for invasive species to spread into new areas. Off-road vehicle use, road closure signage, fencing, informational brochures, and increased CLEO patrolling have been implemented in recent years in hopes of curbing these activities before harsher enforcement actions become necessary.

Figure 7.15: Sahara mustard along the STAC Range Road.

Another factor influencing the spread of invasive plants over the past ten years is the ground disturbance associated with drag roads and the drag areas around rescue beacons along the southern border fence. A network of rescue beacons has been installed throughout the BMGR in an effort to mitigate UDA injuries and/or fatalities arising from the region's extreme environment. The BP will periodically smooth out the areas around the rescue beacons and along the main roads system to enhance detection of recent UDA foot traffic. These drag areas and roads were originally intended to be minimal in size, but have enlarged over time as dragging has continued (Figure 7.15). Disturbance associated with drag roads and drag areas is of particular concern for the spread of invasive species that thrive in disturbed soils. Range managers at both BMGR East and West continue to monitor these roads and maintain a dialogue with the BP regarding impacts and maintenance of these roads.

Wildfire

Wildfires can interfere with the military training and mission readiness, in addition to degrading the range quality for native plant species and wildlife. Wildfires larger than a few acres were almost unknown until the last 15 years because the low densities of native Sonoran Desert vegetation typically do not provide sufficient fuel for carrying a fire over large areas. The spread of invasive plants, however, has substantially raised the threat that wildfire poses to native vegetation and wildlife because the invasive species grow in high densities, will readily carry a wildfire, serve as a ladder fuel into taller stands of native vegetation, and tend to recover from fire more readily than native vegetation. A wildfire that was evidently fueled by Sahara mustard burned approximately 500 acres of native creosote-bursage community at the BMGR West in 2008 or 2009. Field inventory showed that the mustard was the only species recovering in the area after the fire (Malusa 2010).

7.11.1.3 Invasive Plant Management Actions

BMGR East

There has been an observable expansion of buffelgrass along the SR 85 corridor (Figure 7.16), with the vast majority of this expansion occurring outside of the BMGR fence line along the highway right-of-way. Buffelgrass has also been reported in the STAC, areas within the San Cristobal Valley, and within portions of Area B, south of the Crater Mountains, where it appears to be extending away from the highway along several small drainages. Staff from the 56 RMO have conducted a multiyear study examining and mapping the rate of buffelgrass spread along SR 85. Results from the research suggest

that buffelgrass expansion onto the BMGR East is limited to draws and washes, making control efforts feasible (Whittle and Black 2014).

Figure 7.16: Spread of invasive buffelgrass along SR 85 is a growing concern for range managers. Here, 56 RMO staff are monitoring buffelgrass expansion as part of a monitoring and mapping project.

Two other widespread invasive species at BMGR East are Mediterranean grass (*Schismus* spp.) and Sahara mustard. Mediterranean grass is widespread throughout the range and is most common on fine-grained soils. Sahara mustard is most common west of SR 85 and has become well established along many of the NTAC and STAC roadways and within several of the target areas. Both Mediterranean grass and Sahara mustard are annual weeds that appear to be largely dependent on moisture, as they are much more abundant following wet winters.

Luke AFB has developed and implemented an IPMP that includes guidance and protocols for invasive species removal and management for Luke AFB, Gila Bend AFAF, and BMGR East (Luke AFB 2015). This plan outlines the budgeting mechanisms; applicator certification requirements; reporting and recordkeeping requirements; health and safety guidelines; regulatory compliance; herbicide storage mixing, safety, and disposal guidance; and guidance for invasive species removal and control. Methods for control include a combination of physical and mechanical removal as well as the application of herbicide through both foliar spot spraying and aerial application (Figure 7.17). Restricted-use herbicides are not currently approved for use at either Gila Bend AFAF or BMGR East, and only EPA-registered pesticides containing glyphosate as the primary active ingredient are currently being applied at BMGR East. In general, regardless of the manner in which the herbicides are applied at BMGR East, herbicides will be used in a "judicious and prudent manner using products that quickly degrade and have little risk of contaminating water or affecting wildlife" (Luke AFB 2015).

Figure 7.17: A USAF C-130 applying herbicide along a roadway at BMGR East.

Physical removal and disposal of invasive plants by hand is prioritized in small (<100 acres), environmentally sensitive areas. Application of herbicide with ground equipment is being conducted in areas with low-density stands of invasive weeds that

are accessible by vehicle and foot. Ground-based equipment is also being used for targeted applications in accessible infested areas with high densities of environmentally sensitive species. Aerial application of herbicide is restricted to high-density areas of invasive species. It is typically applied by larger aircraft, which may include a USAF C-130 outfitted for pesticide dispersal. The USAF had an Environmental Assessment in place for a Sahara mustard control program using aerial herbicide application for two years at BMGR East (Finding of No Significant Impact was signed on 19 July 2012; 56 RMO 2012). The purpose of this program was to reduce wildfire risk and improve range quality for wildlife and native vegetation communities on approximately 7,800 acres that had high densities of Sahara mustard and few other environmentally sensitive plant species. This program resulted in improved control of Sahara mustard along approximately 15 linear miles of roadways. In the event that aerial herbicide treatments are required in the future, NEPA documents will be prepared. Additionally, the USAF will be required to re-enter consultation with the USFWS prior to conducting any future aerial treatments within Sonoran pronghorn habitat.

The 56 RMO is initiating a similar invasive species mapping and treatment project as BMGR West (detailed below) using the GIS Cloud app. Currently, funding is in place to begin a partnership with the UA to maintain and manage the GIS Cloud app data and to purchase one smartphone with an annual data plan. This device will be used by BMGR East CLEOs and 56 RMO staff to map and monitor invasive species on the east side of the range. In 2019, 56 RMO staff developed and released an educational brochure called "How to Identify & Report Invasive Weeds." The brochure was distributed to BMGR East range users, including Air Force staff, contractors, and BP.

Gila Bend AFAF

The Gila Bend AFAF serves as an emergency runway and provides the facilities required to support maintenance and operations for both the air field and BMGR East. The air field is operated and maintained by a USAF contractor and all pest management functions are completed by the contractor or sub-contractor, as required under the service contract agreement. Gila Bend AFAF utilizes a comprehensive, integrated pest management approach to weed and pest control that takes into account the various chemical-, physical-, and biological-suppression techniques available and analyzes the weed's or pest's habitat and its interrelationship within the ecosystem. Pest management activities at Gila Bend AFAF are guided by the Luke AFB IPMP (Luke AFB 2015) and are specifically addressed in Attachment 7 of that document. The IPMP defines the roles, protocols, contracting requirements, reporting protocols, and treatment procedures for weed and pest management activities at Gila Bend AFAF. The plan also discusses regulatory compliance; safety and health protocols; herbicide/pesticide storage, mixing, and disposal procedures; and provides a list of approved herbicide/pesticides for use on the AFAF. Under this plan, restricted-use pesticides are not permitted to be used oat the AFAF or BMGR East.

Pest issues at Gila Bend AFAF are primarily related to BASH threat species, including round-tailed ground squirrel (*Spermophilus tereticaudus*), coyote (*Canis latrans*), rock pigeon (*Columba livia*), and a variety of dove species including the mourning dove, white-winged dove, and Eurasian collared-dove (*Streptopelia decaocto*). Weed issues are similar to those found at BMGR East and include Sahara mustard and buffelgrass. All pest management actions at Gila Bend AFAF are recorded and retained within the Integrated Pest Management Information System program.

BMGR West

The MCAS Yuma RMD, in cooperation with the 56 RMO, partnered with researchers from the UA to characterize and model Sahara mustard invasion throughout BMGR. This study combined field measurements, controlled experiments, and mathematical modeling to determine environmental factors that affect Sahara mustard success and long-term impact on other native winter-annual plants. More specifically, this study examined how spatial variation in both biotic and abiotic environments affected the population growth of Sahara mustard as well as its impact on native plants. It also attempted to quantify the natural dispersal range of the invasive species to better estimate the rate of spread across the range.

Results from this research (Li and Malusa 2014, Li 2016) are encouraging, as it seems that Sahara mustard can be effectively controlled because the seedlings are vulnerable to adverse post-germination conditions; on a range-wide scale, after extended periods of winter drought, Sahara mustard source populations are reduced to isolated areas where soils retain moisture. These populations will expand again across the landscape as favorable conditions return. Successful elimination of persistent local populations after droughts can effectively reduce the species' presence over the range. The knowledge gained from this study has provided strong scientific insight for managing Sahara mustard, and led to the development of a management program adopted by the BMGR West RMD to reduce the presence of this species over time.

This management program involves a continuing partnership with the MCAS Yuma RMD, UA, and NPS Lake Mead Exotic Plant Management Team. This project employs cloud-based mapping to document invasive species presence across BMGR West, allowing for targeted follow-up control efforts to be implemented as efficiently as possible. The project is designed to give managers a timely method for mapping and tracking the spread of invasive weeds across the range, with particular focus on Sahara mustard and buffelgrass. This effort is based on cloud-based mapping using the GIS Cloud app and smartphones to quickly and easily gather data on invasive species distribution and abundance. The app records the sighting location and provides dropdown menus for recording the species and estimating its abundance. In addition, there are options to record photos, audio, and take specific notes for each point. Once completed, these points are automatically uploaded to an online map that makes the data immediately available to UA staff and the Lake Mead Exotic Plant Management Team. The mapping effort is coordinated primarily through Station's four CLEOs using smartphones with the GIS Cloud app. CLEOs from MCAS Yuma are typically the first to discover new invasive species populations and provide key survey data for the project.

As their part of this partnership, UA staff are tasked with data-quality control, interpretation, expert surveys to assess current invasion conditions, maintaining the GIS Cloud app, and prioritizing treatment areas based on real-time distribution of invasive plant emergence and habitat favorability of the invasive species. UA staff also perform before/after surveys of treatment areas and generate reports detailing the success or failure of each treatment effort and analyzing the results of the generated distribution models. Due, in part, to the simplicity and effectiveness of the GIS Cloud app, MCAS Yuma RMD staff, BMGR West CLEOs, and UA staff together collected 1750 data points during the winter of 2016–2017 and over 2,800 data points since the program's inception in 2015.

Upon receipt of data from the GIS Cloud app (Figure 7.18) and treatment recommendations from UA staff, the NPS Lake Mead Exotic Plant Management Team determines and implements the appropriate weed control treatment for each area provided. Treatment options include foliar spot spraying, cut-stump treatments, and manual removal. All herbicide mixture and application practices follow explicit NPS protocols and regulations. In addition, the NPS team purchases, stores, and delivers herbicides to project sites and observes all herbicide label requirements and guidance for each of the planned treatment options. The NPS team also completes and maintains the required MCAS Yuma Pesticide Application records and submits them after each herbicide application project is completed.

Other contributions from the NPS Team include gathering, updating, and providing GIS information on potential areas identified for treatment during the following year; maintaining accurate records of project activities (using GPS/GIS technology), including tracking the amount of herbicide and other chemicals used (i.e., surfactants), areas surveyed, and acres and species treated; and then compiling their work into a final annual report that is electronically submitted to MCAS Yuma RMD within 30 days of project completion. One major benefit of this project is that MCAS Yuma personnel never have to handle or apply any herbicides. Since the GIS Cloud app monitoring and treatment program began in 2015, the NPS team has actively treated five invasive species, including Sahara mustard, buffelgrass, salt cedar, Athel tamarisk, and fountain grass. Accumulatively, 6,739 acres have been surveyed, resulting in the treatment of 11 acres (Table 7-2).

One important outcome of this program is extensive knowledge of the occurrence and abundance of invasive plants, especially Sahara mustard at BMGR West. According to this known distribution of Sahara mustard, BMGR West is subjected to substantial invasion pressure from the species' source populations outside of the range's jurisdiction. Successful control of Sahara mustard requires sufficient interagency collaborations to contain invasive populations at BMGR East, Cabeza Prieta NWR, and other agency land (BLM, Bureau of Reclamation, etc.). The success of the management program has prompted staff at the Cabeza Prieta NWR to adopt the GIS Cloud app to monitor and treat Sahara mustard and buffelgrass on the Refuge. Staff from the 56 RMO at BMGR East will initiate use of the app in spring 2018. In addition, staff from the El Pinacate Preserve in Mexico have expressed interest in initiating a similar monitoring program. It is desirable to establish an interagency program that can sufficiently standardize the use of the GIS Cloud app across agencies and coordinate treatment efforts among agencies to target source populations that infest areas across jurisdictional boundaries.

Table 7-2: Invasive plant treatment efforts for BMGR West, 2015–2017.

Species	Year	Surveyed Acres[1]	Infested Acres[1]	Gross Infested Acres Treated[1]	Treated Acres[1]
Sahara mustard (*Brassica tournefortii*)	2015	1192.00	1.06	62.09	1.06
Buffelgrass (*Pennisetum ciliare*)	2015	1192.00	1.25	13.15	1.25
Salt cedar (*Tamarix ramosissima*)	2015	1192.00	0.02	0.15	0.02
Athel tamarisk (*Tamarix aphylla*)	2015	1192.00	0.00004	0.00005	0.00004
Fountain grass (*Pennisetum setaceum*)	2015	1192.00	0.0005	0.003	0.0005
Sahara mustard (*Brassica tournefortii*)	2016	3777.29	4.37	538.19	4.37
Buffelgrass (*Pennisetum ciliare*)	2016	3777.29	0.08	6.66	0.08
Salt cedar (*Tamarix ramosissima*)	2016	3777.29	0.002	0.02	0.002
Sahara mustard (*Brassica tournefortii*)	2017	1769.30	4.00	598.11	4.00
Buffelgrass (*Pennisetum ciliare*)	2017	1769.30	0.03	5.23	0.03
Total		**6739 acres**	**11 acres**	**1224 acres**	**11 acres**

[1] Acreage Definitions*

Surveyed Area: Any area covered during the course of weed management / control activities. An area may be considered "surveyed" regardless of the presence / absence of target weed species. Surveyed area is obtained by walking the perimeter or taking perimeter points with a GPS unit, or by digitizing area on a screen using landform references.

Gross Infested Area: The gross infested area is defined as the general perimeter of the infestation. Gross infested areas contain the target species and the spaces between populations or individuals. A gross infested area is calculated by adding up the total acreage of all mapped weed infestations, without taking into account percent cover.

Net Infested Area: Actual area occupied by weed species within the gross infested area, which does not contain the spaces between individuals and populations. The total infested area (with the gross infested area) may be comprised of multiple infested areas, described by polygons, buffered points, buffered lines, or it may be calculated as the result of a stem count in which each individual is assigned a coverage multiplier.

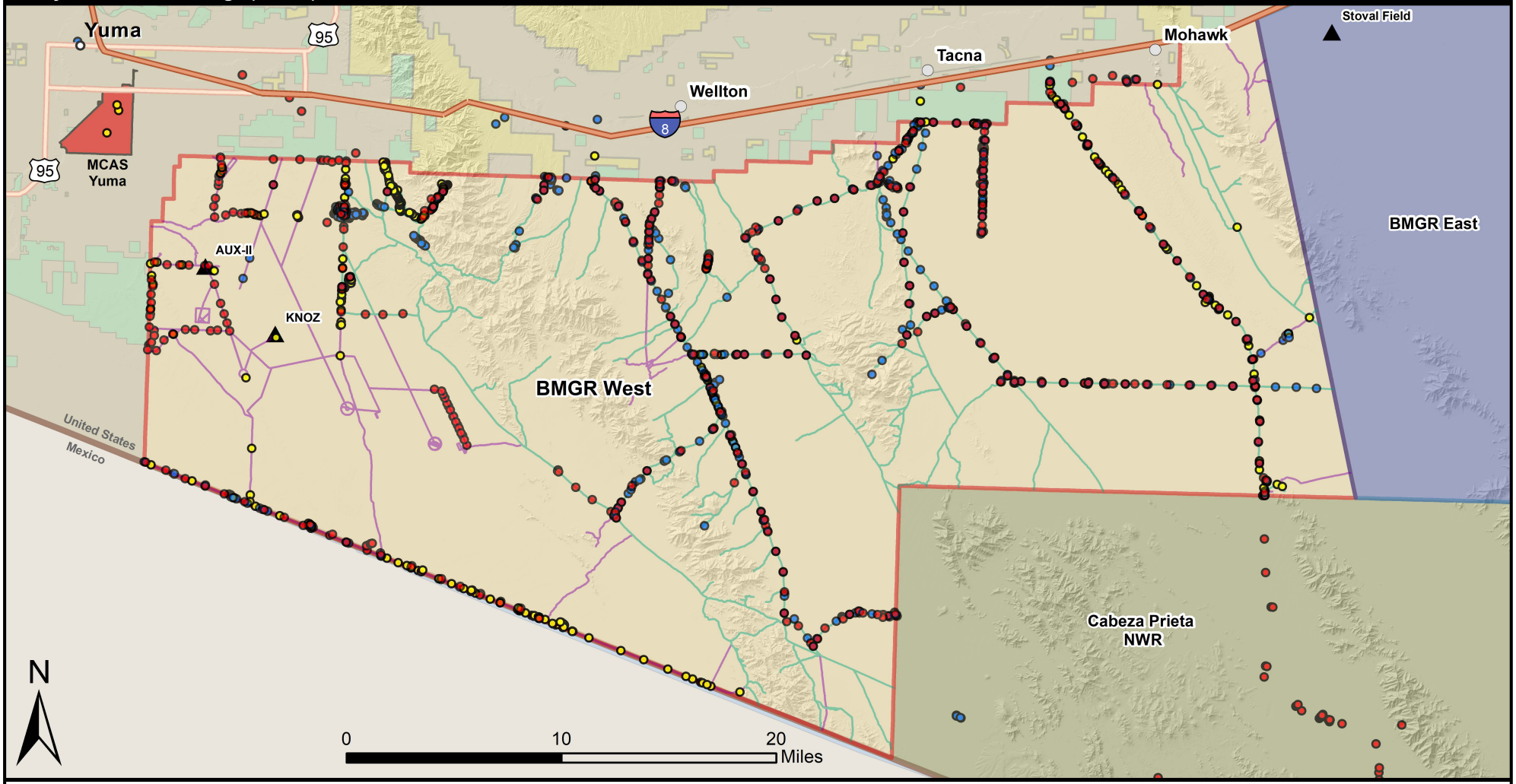
Net Treated Area: Treated area is either the infested area or a subset of an infested area that has received treatment. Treatment area is calculated using the same standards as those for infested area.

* All of these terms apply to single-species measurements. When there is more than one weed species in an area, the above measurements need to be applied to each species (population) individually.

Figure 7.18: GISCloud App Invasive Species Mapping at BMGR West

Barry M. Goldwater Range (BMGR)

2018-2023 Integrated Natural Resource Management Plan (INRMP)



Legend

- City/Town
- Interstate 85
- Highways
- MCAS Yuma
- BMGR East
- BMGR West
- Cabeza Prieta NWR
- BLM
- State Trust Land
- BMGR Designated Admin Use Only Road
- BMGR Designated Public and Admin Use Road
- Auxiliary Airfield (AUX)
- GISCloud Weed Survey 2016-2017
- GISCloud Weed Survey 2015-2016
- GISCloud Weed Survey 2014-2015

World Geodetic System 1984 (WGS84) Projection
Zone 11 N
GCS_WGS_1984

Base data from ESRI StreetMap
Hillshade derived from USGS NED

Created By:
Center for Environmental Management
MILITARY LANDS
Colorado State University

7.11.2 BMGR East Trespass Livestock

Figure 7.19: Trespass burros impacting areas of BMGR East.

Since the early 1970s, feral horses and burros (*Equus* spp.) have received protection by the federal government under provisions of the Wild Free-Roaming Horses and Burros Act of 1971 (WFRHBA) (16 U.S.C. §§ 1331-1340) as amended by the Federal Land Policy and Management Act of 1976 (FLPMA) and the Public Rangeland Improvement Act of 1978 (PRIA). Technically, these animals are not wildlife; rather, they are descendants of escaped livestock. The term "wild free-roaming" provides special protections to these animals under the WFRHBA. On a national scale, the management of feral horses and burros has fallen to the BLM or U.S. Forest Service when these animals are found within a designated Wild Horse and Burro Herd Management Area (HMA). HMAs were designated in the PRIA and represent areas where wild horses and burros were documented at the time of the passage of the WFRHBA. Each HMA has an associated management plan that provides specific herd management goals and objectives and determines what each HMA's carrying capacity or "Appropriate Management Level (AML)" should be. The HMA management plan also determines what the minimum and maximum population levels are for wild horses and burros to allow for population growth over a four- to five-year period. Each HMA's AML is determined through a rigorous, multi-year analysis and evaluation of rangeland habitat conditions, including data on each area's vegetation and soil resources. The AML, along with any revision to the AML, is set for each HMA in an open, public process during field planning efforts.

Figure 7.20: Impact to native vegetation by trespass livestock. This ocotillo has been partially girdled by trespass burros.

While stringent management guidelines are required under federal law for animals found within an HMA, animals found outside of an HMA are not provided the same protections and are often considered to be "estrays" or unauthorized horses and burros in trespass. Herd population evaluations and management constraints are not required, and the management of these trespass animals often defaults to the local land management agency as well as the state. The BMGR does not contain a designated Wild Horse and Burro HMA. The closest HMA to the BMGR is the Cibola-Trigo HMA, located 8 miles north of the BMGR West or 40 miles west of the BMGR East along the Colorado River (Figure 7.23). Management of trespass horses

and burros at BMGR has fallen to the 56 RMO and MCAS Yuma RMD staff at BMGR East and West, respectively. The 2007 and 2012 INRMPs, as well as the annual INRMP reviews (2013–2017), have repeatedly expressed that trespass livestock, specifically cattle, horses, and burros (hereafter "trespass livestock"), are an increasingly greater problem. Impacts of these animals to natural resources are typically greater at BMGR East given its proximity to adjacent grazing allotments and other land uses. Issues and impacts related to trespass livestock that either have been observed occurring or have the potential to occur at BMGR include, but are not limited to

- extensive destruction and degradation of sensitive plant species and Sonoran Desert native plant communities;
- increased competition with native protected/endangered wildlife species for available forage and water resources (i.e., Sonoran pronghorn);
- potential for disease transmission to native wildlife species;
- increased soil degradation and erosion potential;
- surface water depletion and destruction of environmentally sensitive/culturally significant water resources;
- potential water-quality impacts associated with fecal contamination and increased erosion and sedimentation;
- destruction and trampling of cultural resource sites;
- invasive plant species seed dispersal; and
- increased public safety risk from livestock/vehicle collisions with potential to impact all range users including
    - public recreationists;
    - BP;
    - 56 RMO and MCAS Yuma RMD staff and support personal, other range managers, and contractors; and
    - military personnel.
- Potential direct negative impacts to the military training mission include but are not limited to
    - delays, interruptions, and cessation of live-fire training missions if animals are on range;
    - increased risk of vehicle collisions during ground-based training efforts; and
    - increased wildfire risk if trespass animals aid in the dispersal of fire-adapted weed species.

Given that BMGR does not contain a designated Wild Horse and Burro HMA and that protections provided under applicable federal law (i.e., WFRHBA, FLPMA, PRIA) do not extend to trespass horses and burros on the range, the 56 RMO and MCAS Yuma RMD staff wish to develop policies, programs and methods to aid in the management of these animals. Consequently, 56 RMO and MCAS Yuma RMD staff and staff at partner agencies, AGFD and USFWS, were prompted during the 2016 INRMP Annual Review process to revise the Resource-Specific Goal RS4.5 from "Remove privately owned

animals from the BMGR" to "Monitor and control trespass animals and livestock at the BMGR, and assess and mitigate their impacts."

Based on this revised Resource-Specific Goal, the 56 RMO staff at BMGR East are planning to develop a Trespass Livestock, Horse, and Burro Management Plan that addresses all aspects of management and monitoring of these animals and defines the roles and responsibilities for all parties henceforward. This plan will ensure humane treatment of all animals while reducing impacts to natural and cultural resources and the military training and mission readiness. This plan will provide clear policies, programs, and methods to ensure that the INRMP goal of monitoring and controlling trespass animals and livestock is met.

While the development of this management plan will be a priority over the next five years, there are management actions that the 56 RMO staff can initiate now, under this INRMP, in recognition of the need to reduce negative impacts from trespass livestock. These include the strategies as follows.

Working with Surrounding Land Management Agencies

The 56 RMO and MCAS Yuma RMD staff will work cooperatively with surrounding land management agencies and individuals (BLM, USFWS, BLM grazing permittees, Tohono O'odham Nation), as well as the Arizona Department of Agriculture (AZDA) and the AGFD, to ensure coordinated management of trespass livestock. In addition, staff from the BMGR will continue to participate in the Interagency Feral Livestock Committee.

Fencing

The BMGR staff recognize that Arizona is a fence-out state, meaning it is the property owner's responsibility to keep animals out, and that the BMGR does not reside in an Arizona no-fence district. While it is unfeasible to fence the entire boundary of the BMGR, certain corridors can be effectively fenced off to exclude trespass livestock. The BMGR staff will prioritize efforts to work with adjacent BLM staff and BLM grazing permittees to install new wildlife-friendly fencing, as appropriate, in strategic areas and monitor existing fencing. In addition to installing new fencing, the existing fence infrastructure will be maintained and improved as needed. The presence of trespass livestock will be continually monitored to identify additional access corridors onto the range that need fencing infrastructure installed.

Figure 7.19: Example of strategic fencing being used at BMGR East to exclude trespass livestock.

Trespass Livestock Removal and Management

Trespass livestock will be prioritized for removal from the BMGR lands following all applicable state and federal laws. The BMGR staff will work with ranchers and stakeholders to push back into BLM-managed areas any privately owned, BLM permittee livestock found on the range. All other privately

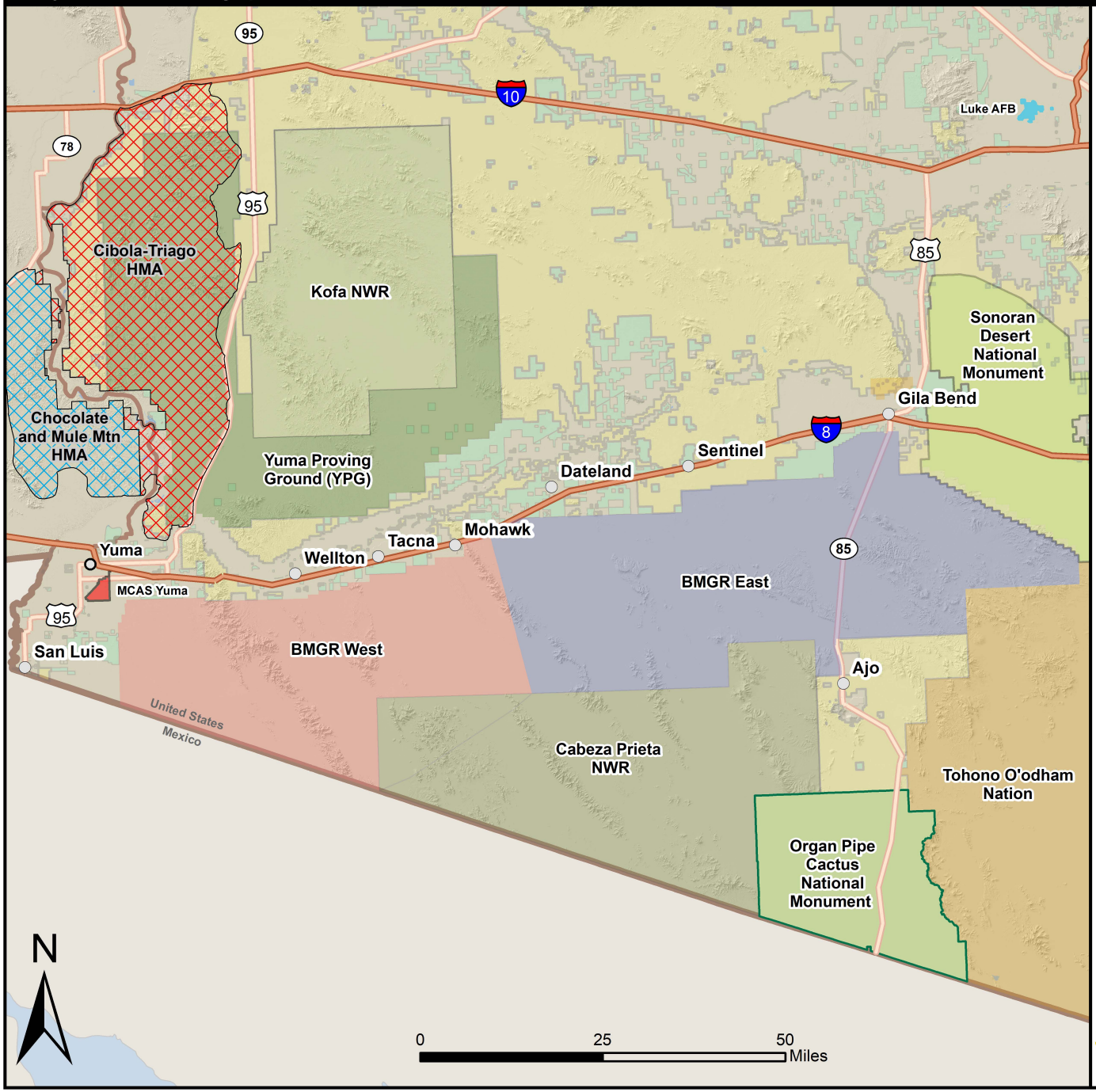
owned livestock will be rounded up and held for property recovery procedures to occur, as determined by ARS 3-1402 and 43 CFR Subpart 4150. The AZDA will complete brand inspections on all trespass livestock, and the 56 RMO will post notifications to allow owners an opportunity to recover trespass livestock.

Figure 7.20: Trespass livestock at BMGR East.

For non-branded stray livestock that are not claimed during the established recovery notification period, as outlined in ARS 3-1402, the 56 RMO shall provide a letter to the AZDA stating that all applicable state, federal and DoD rules were followed, allowing the AZDA to produce a Form 1 letter (after the livestock inspection) that will authorize USAF ownership of the animals. On becoming USAF property as determined by the State of Arizona, these animals will be sold at public auction. To initiate this new trespass livestock removal policy, staff at the 56 RMO are currently pursuing viable procurement methods and opportunities that may be used by a contractor selected to perform duties under an awarded contract. Such duties could include but would not be limited to actively riding the range, monitoring the presence of trespass livestock, inspecting and repairing fencing, and removing trespass livestock as necessary by using established protocols and or procedures, as set forth under law and or an issued Statement of Work. The 56 RMO would also explore the possibility of having the contractor monitor for invasive weeds as well as observe and report on any other known or potential impact to natural and cultural resources.

Figure 7.23: Wild Horse and Burro Herd Management Areas (HMA)
Barry M. Goldwater Range (BMGR)

2018-2023 Integrated Natural Resource Management Plan (INRMP)



Legend

- Chocolate/Mule Mtn HMA, Wild Horse/Burro Area
- Cibola-Triago HMA, Wild Horse/Burro Area
- City/Town
- BMGR East
- BMGR West
- MCAS Yuma
- Interstates
- Highways
- Luke AFB
- Yuma Proving Ground
- Organ Pipe Cactus NM
- Cabeza Prieta NWR
- Kofa NWR
- Sonoran Desert NM
- Tohono O'odham Nation
- BLM
- State Trust Land

World Geodetic System 1984 (WGS84) Projection
Zone 12 N
GCS_WGS_1984

Base data from ESRI StreetMap
Hillshade derived from USGS NED

Created By:
Center for Environmental Management
MILITARY LANDS
Colorado State University

7.12 Bird/Wildlife Aircraft Strike Hazard (BASH)

Figure 7.22: Turkey vultures represent a major BASH threat. Photo curtesy of NPS.

The BMGR lies within the Pacific Flyway, which, at this location, is a minor flyway for waterfowl and a major flyway for raptors and small songbirds. The BMGR serves as an important training area for aircraft from the 56 FW out of Luke AFB and Marine Corp Air Squadrons out of MCAS Yuma. BASH reduction plans are developed for DoD military installations where elevated hazards exist and can be controlled and mitigated, as is the case at the BMGR East and West.

BMGR East

BASH concerns are greatest when aircraft fly at low altitudes (at both takeoff and landing) rather than during typical in-flight operations at BMGR. A BASH Reduction Plan is in place for Gila Bend AFAF. In accordance with this plan, the USAF uses the AHAS, which is a data-driven, remote-sensing system to alert aviators about the presence of birds in the airspace. The AHAS system evaluates weather and radar data and provides real-time alerts to aviators when concentrations of large birds are in the airspace. The AHAS is available online and coverage includes the entire continental U.S. Additionally, as part of the prevention program, AHAS provides pilots and flight schedulers with a near real-time tool when selecting flight routes. The BMGR East plan is based on Luke AFB's BASH Reduction Plan and 56 FW OPLAN 91-2 (56 FW 2013), and it focuses on reducing the BASH threat at the Gila Bend AFAF and at the Range 1 and 2 lead-in-lines.

Figure 7.23: F-16 preparing for take-off at Gila Bend AFAF. Photo courtesy of Luke AFB.

Environmental management guidelines, as identified in the BASH Reduction Plan for Gila Bend AFAF, include controlling vegetation (e.g., maintaining vegetation height between 7" and 14 inches, removing dead vegetation, removing perches), controlling water (e.g., modifying ditches, eliminating standing water), controlling waste (e.g., collecting and disposing waste rapidly), and controlling birds through chemical and physical alterations (e.g., bird-proof structures, insect and rodent control). Priority BASH management actions under this plan include vigilant threat monitoring and reporting, management of the environment both at and surrounding the Gila Bend AFAF, carrion removal along SR 85 to reduce the abundance of large avian scavengers (e.g., turkey vultures), and bird/wildlife harassment and depredation, as required. A private contractor is currently conducting daily threat monitoring at Gila Bend AFAF and for areas of BMGR East near Range 1 and 2. Status reports are issued on a monthly basis. These reports summarize, in part, the number of BASH strikes/month, number of BASH threat days/month, number of surveys

conducted/month, average number of birds by size, max and mean animal counts/month by species, total carrion removed/month and location of disposal, and other environmental information (e.g., wastewater pond depth). In addition to monthly reporting, the contractor is also providing annual BASH reports that summarize and analyze all monthly data and provides useful trend data to the 56 RMO (Tunista Services, LLC, and Chiulista Services 2012–2016). A summary of the annual BASH management data results for 2012–2016 is provided in Table 7-3.

Table 7-3: Summary of BASH management actions taken annually over the last five years (2012–2016) at the Gila Bend AFAF and other areas at BMGR East.[1]

Year	BASH Threat Days			BASH Strike	Carrion Removed	Number of Times	
	Low	Moderate	Severe			Wildlife Harassed	Wildlife Depredated
2012	247	0	0	1	149	5	0
2013	249	1	1	2	192	6	0
2014	269	6	0	1	273	8	0
2015	269	4	0	2	396	1	0
2016	250	3	0	1	200	16	0
Total	**1,284**	**14**	**1**	**7**	**1,210**	**36**	**0**

[1] Source: The Annual BASH Summary Reports for the BMGR East (Tunista Services, LLC, and Chiulista Services 2012–2016).

Bird harassment and depredation at Gila Bend AFAF is authorized by the USFWS through a permit issued annually to the 56 FW, which applies to both Luke AFB and Gila Bend AFAF (USFWS 2017). A log of BASH harassment and depredation events at Gila Bend AFAF is being retained and updated by the 56 RMO and includes all incidents dating back to 2006. Mammal depredation (e.g., rabbits and coyotes) at Gila Bend AFAF is authorized by a permit issued annually by AGFD to the 56 RMO/ESM and applies only to Gila Bend AFAF.

Primary avian species surveyed under this project include, but are not limited to, turkey vulture (*Cathartes aura*), common raven[s (*Corvus corax*), raptors species (e.g., red-tailed hawk [*Buteo jamaicensis*]), prairie falcon, golden eagle, American kestrel (*Falco sparverius*), etc.), doves (mourning doves, white-winged doves, Eurasian collared-doves), and horned larks (*Eremophila alpestris*). Round-tailed ground squirrels are also surveyed at Gila Bend AFAF, as they represent one of the main food sources for raptors species. Data are provided in the Annual BASH Summary Report for the BMGR East (Tunista Services, LLC, and Chiulista Services 2012–2016). Species included in the "other" species category include lark bunting (*Calamospiza melanocorys*), greater roadrunner (*Geococcyx californianus*), green-winged teal (*Anas crecca*), long-billed curlew (*Numenius americanus*), black-tailed jackrabbit (*Lepus californicus*), coyote, and kit fox.

Table 7-4: Summary of annual survey results for four locations at Gila Bend AFAF and BMGR East.

Species	Year	Gila Bend AFAF			Gila Bend AFAF Perimeter			SR 85 (Range 1 and 2)			Gila Bend AFAF Oxidation Pond		
		Total Individuals	Times Observed	No. Surveys	Total Individuals	Times Observed	No. Surveys	Total Individuals	Times Observed	No. Surveys	Total Individuals	Times Observed	No. Surveys
Avian sp.	2012	9,440	247	247	1,213	72	72	968	113	113	4,581	74	74
Ground squirrel	2012	384	127	247	0	0	72	0	0	113	0	0	74
Other	2012	658	136	247	2,652	71	72	540	98	113	1,978	74	74
Total		**10,482**		**247**	**3,865**		**72**	**1,508**		**113**	**6,559**		**74**
Avian spp.	2013	13,408	251	251	2,678	108	108	1,409	138	138	5,888	107	107
Ground squirrel	2013	124	58	251	0	0	108	0	0	138	0	0	107
Other	2013	1,525	178	251	3,236	108	108	383	117	138	3,130	106	107
Total		**15,057**		**251**	**5,914**		**108**	**1,792**		**138**	**9,018**		**107**
Avian spp.	2014	17,251	251	251	3,668	113	113	1,891	148	148	7,097	87	87
Ground squirrel	2014	200	79	251	0	0	113	0	0	148	0	0	87
Other	2014	1,759	248	251	3,835	113	113	825	134	148	3,809	87	87
Total		**19,210**		**251**	**7,503**		**113**	**2,716**		**148**	**10,906**		**87**
Avian spp.	2015	15,598	250	250	2,295	88	88	2,381	173	173	4,270	81	81
Ground squirrel	2015	164	93	250	0	0	88	0	0	173	0	0	81
Other	2015	893	34	250	3,560	88	88	364	95	173	2,804	81	81
Total		**16,655**		**250**	**5,855**		**88**	**2,745**		**173**	**7,074**		**81**
Avian spp.	2016	8,640	254	254	3,152	147	147	1,949	107	107	5,540	131	131
Ground squirrel	2016	300	122	254	0	0	147	0	0	107	0	0	131
Other	2016	1,011	150	254	3,271	147	147	407	102	107	3,423	81	131
Total		**9,951**		**254**	**6,423**		**147**	**2,356**		**107**	**8,963**		**131**
All Years Total		**71,355**		**1,253**	**29,560**		**528**	**11,117**		**679**	**42,520**		**480**

Source: The Annual BASH summary reports for BMGR East (Tunista Services and Chiulista Services 2012–2016.

BMGR West

A BASH Reduction Plan has been developed and implemented for the BMGR West (USMC 2014). The BASH program is governed by the MCAS Yuma BASH Working Group, which meets quarterly to assess the status of the BASH Reduction Program and provides recommendations and guidance for improving program delivery. These meetings are held in conjunction with the Commanding Officer's Safety Council meetings and are coordinated by the MCAS Yuma Installation Aviation Safety Officer. Personnel on the BASH Working Group are listed below.

- Commanding Officer (Chairperson)
- Airfield Operations Officer
- Air Traffic Control Facility Officer
- Conservation Manager
- Aviation Safety Officer
- Natural Resources Specialist
- Pest Management Officer
- Tenant Unit Representatives
- Marine Aircraft Group 13
- Marine Aviation Weapons and Tactics Squadron 1
- Marine Fighter Training Squadron 401

The MCAS Yuma BASH Reduction Plan outlines the management requirements and coordination procedures for all BASH Working Group personnel. The MCAS Yuma Conservation Manager maintains all required dispersal/depredation permits and harassment/depredation equipment. The MCAS Yuma Conservation Manager also retains all BASH records and ensures that properly trained personnel are available for required management actions. The Conservation Office monitors migratory, seasonal, and resident bird activities and serves as liaison between MCAS Yuma and the USFWS, AGFC, U.S. Department of Agriculture Animal and Plant Health Inspection Service, and the Audubon Society. All remains from BASH strike incidents are sent to the Smithsonian Institute for official review, identification, and cataloging.

7.13 Coastal Zone and Marine Resources Management

The BMGR does not encompass any coastal or marine areas. The coastal area nearest to the installation is the Gulf of California, Mexico, approximately 40 miles south of the installation.

7.14 Cultural Resources Protection

The USAF and USMC are responsible for protecting and managing the cultural resources at BMGR in accordance with a suite of federal laws and regulations. Federal law protects cultural resources that satisfy government criteria for being listed on the National Register of Historic Places. The USAF and USMC, in consultation with tribes and other interested parties, work with the Arizona State Historic

Preservation Office in Phoenix, Arizona, to determine which resources are eligible for listing. Activities that provide protection for cultural resources at BMGR indirectly support the military mission by preventing or minimizing conflicts between military operations and resource protection goals.

BMGR East

The most recent ICRMP for BMGR East was finalized and signed in January 2020. A key component of the MLWA is the integration of natural and cultural resource concerns through the successful implementation of the ICRMP and INRMP. These efforts have been identified as a series of action items, some of which are high priorities for the five years covered by the ICRMP. These action items are listed below.

- Complete surveys and Section 106 reviews as needed to support range improvements and sustain the training mission.
- Sustain the training mission by including actions proposed in the CRP (in prep.)
- Carry out the actions required under the programmatic agreement for INRMP implementation and complete cultural resource inventories and Section 106 review of INRMP-related actions not covered by the programmatic agreements.
- Synthesize cultural resource data, evaluate the historic significance of recorded resources, and make determinations of eligibility for inclusion on the National Register of Historic Places.

Archaeological surveys have been conducted in both military use zones and public access areas. Public recreation, and the associated effects, are potential threats to cultural resources. To determine the extent of the threat, the programmatic agreement for implementation of the 2007 INRMP required the prioritization of surveys along roads and adjacent areas likely to be affected by public access (56 RMO 2009). Surveys conducted along public access roads in Area B have identified at least 39 resources eligible for inclusion on the National Register of Historic Places (Tagg and Blake 2012). The USAF developed strategies to protect these resources from public use activities, such as vehicle based camping, campfires, theft, and vandalism. Strategies include regular monitoring of known resources, permit enforcement, and increased recreational supervision.

Most of the projects that require surveys of large, contiguous areas are related to military actions. The 56 RMO is committed to systematic surveys of areas affected by ongoing training activities and, as of 2015, surveys had been conducted on 199,391 acres of BMGR East. Surveys and projects that have been completed since the 2012 INRMP are listed below.

- Completed in 2012—Intensive archaeological survey of 1,003 acres on Manned Range 1
- Completed in 2012—Petroglyph recording: Lookout Mountain, Area B
- Completed in 2012–2013—Archaeological survey and condition assessment of the GPS site (AZ Z:5:55 [Arizona State Museum])
- Completed in 2012–2013—Stoval Supplemental Project: Resurvey 50 acres and archeological testing of six sites

- Completed in 2013—Pathways to Preservation: Archaeological Research Design and Management Strategy for the Barry M. Goldwater Range East
- Completed in 2013—Petroglyph recording, Black Tank, Range 2
- Completed in 2014—Intensive archaeological survey of 155 acres for the Sierra del Diablo pronghorn forage plot pipeline realignment in the Southern San Cristobal Valley
- Completed in 2014—Emergency archaeological survey, rerecording, and remapping of AZ Z:5:68 (Arizona State Museum)
- Completed in 2014—Hand excavation testing to determine presence of subsurface archaeological site
- Completed in 2015—Mechanical excavation to determine content and extent of AZ Z:5:68 (ASM)
- Completed in 2015—Draft and final Historic Properties Treatment Plan for data recovery
- Completed in 2015—Archaeological data recovery at five sites within the runway clear zone, Gila Bend Air force Auxiliary Field (AFAF)
- Completed in 2015—Intensive archaeological survey of 500 acres in Rankin Valley
- Completed in 2015—Intensive archaeological survey of 154 miles (6,209 acres) and 2,831 acres of interstitial space: recording of 106 sites
- Completed in 2017—Intensive archaeological survey of 1,500 acres of Rankin Valley
- Completed in 2017—Data recovery within the APE of AZ Z:5:68 (ASM), Range 1 Road Emergency
- Completed in 2017—Native American Graves Protection and Repatriation Act reburial on the Tohono O'odham Nation
- Completed in 2016—Vanderpot, Rein, et. al., Gila Bend Air Force Auxiliary Field: Archaeological Data Recovery at Five Sites and One Isolate within the Airfield Flight-Line Clear Zone, Barry M. Goldwater Range East, Arizona. Cultural Resource Studies in the Western Papagueria 30, Barry M. Goldwater Range East Cultural Resource Management Program, Luke AFB, Arizona
- In-house projects
    - Intensive archaeological surveys for remodeling artificial wildlife waters, placement of weather stations, pronghorn forage plots and waters, removal of contaminated soil, wildcat roads, and extensions to existing roads
    - Site condition assessments of sites on all three tactical ranges

The Arizona Site Stewards Program (ASSP) is a key component of site monitoring efforts at BMGR East. The ASSP trains and uses volunteers to monitor sensitive or threatened sites on public lands throughout the state. Currently over 30 site stewards work on the BMGR East. Their efforts constitute a crucial supplement to the limited staff resources of most federal and state agencies. Site Steward training involves both classroom instruction and fieldwork covering antiquity laws, crime-scene management, site and feature identification, and map reading.

The ASSP is led and sponsored by Arizona State Historic Preservation Office, the Governor's Archaeology Advisory Commission, and public land managers throughout Arizona, including the 56 RMO. The 56 RMO cultural resource manager serves as the Agency Coordinator for ASSP activities and identifies and prioritizes sites to be monitored and prepares handbooks to be used for this purpose by Site Stewards. A volunteer Regional Coordinator monitors the activities of Site Stewards working at BMGR East.

BMGR West

The MCAS Yuma and 56 RMO cultural resources programs for BMGR West and East, respectively, produced a three-volume ICRMP in 2009. The ICRMP provides guidance for managing cultural resources on the entire BMGR in accordance with the National Historic Preservation Act and other applicable laws and regulations. Volume 1 addresses the background and management issues germane to both BMGR West and East—the physical setting, resource laws, culture history, and other landscape-scale elements. Volume 2 specifically addresses BMGR East and, as mentioned above, is superseded by a 2017 ICRMP. Volume 3 specifically addresses BMGR West.

In 2011, the MCAS Yuma Cultural Resources Manager considered the writing of the BMGR West portion of the most recent ICRMP to be complete. The final draft of the ICRMP, however, was never presented to the Commander for signature; thus, it was never executed. MCAS Yuma awarded a contract in August 2017 to have the 2011 ICRMP rewritten to correct deficiencies and update the management strategy. Completion of the new BMGR West ICRMP is anticipated in September 2019 and, among other changes, it will include Standard Operating Procedures and an assessment of current data gaps.

Approximately 137,000 acres (20 percent) of the roughly 694,000 acres of the western portion of BMGR West has been systematically surveyed. These surveys have resulted in the recording of approximately 350 sites. Survey reports completed since 2012 are listed below.

- Completed in 2013—Cultural resources survey for a renewable energy project for MCAS Yuma
- Completed in 2013—Archaeological Survey Report of Negative Findings for the Laser Spot Video Recording System at Barry M. Goldwater Range West
- Completed in 2014—Archaeological Survey Report of Negative Findings for the Range One Expansion on the Barry M. Goldwater Range West
- Completed in 2015—An archaeological survey of 21,941 acres at Barry M. Goldwater Range West, Marine Corps Air Station, Arizona
- Completed in 2015—Archaeological Survey Report of Negative Findings for a Proposed Earthquake Early Warning Sensor on the Barry M. Goldwater Range West
- Completed in 2016—Archaeological survey of 6,289 acres on the Barry M. Goldwater Range West, Yuma County, Arizona
- Completed in 2016—Archaeological Survey of 26,172 Acres on the Barry M. Goldwater Range West, Marine Corps Air Station Yuma, Arizona

The MCAS Yuma cultural resources program, in accordance with Section 110 of the National Historic Preservation Act, requests funding each year to complete the survey of BMGR West. As with BMGR East, this goal will not be realized for several years simply due to the magnitude and cost of the task. The ICRMP update, now underway, will detail the Marine Corps' short and long-term plans for compliance with Section 110.

7.14.1 Integrated Natural-Cultural Resources Management

There are several areas of overlap in the management of cultural and natural resources on the BMGR. Integrating the ICRMP and the INRMP are essential for meeting the requirements of the National Historic Preservation Act (NHPA), 54 U.S. Code, Sections 101 [d] [1]; [d] [6], Section 110 [a] [2], and Section 106; the ESA; NEPA, the Military Lands Withdrawal Act of 1999 (MLWA); AFMAN 32-7003, Environmental Conservation, and DoD American Indian and Alaska Native Policy.

It is DoD Policy to consult with and incorporate American Indian views into cultural and natural resource management of military lands. Both ICRMPs and INRMPs must consider the conservation of "protected tribal resources", which are natural resources and properties of traditional, religious, or cultural importance, either on or off Indian lands, and incorporate this information into management plans.

Consultation with Native American tribes (hereafter 'Tribes'), a key component and requirement of DoD Policy and various statutes, has revealed that Tribes consider natural resources to be primarily cultural resources. Therefore, undertakings that affect natural resources are subject to Section 106 review, in addition to natural resource legislation and regulatory process when endangered species are involved.

Tribes have a living connection to the landscape; it is dotted with special places. Tribal cultural and spiritual values are based on the interwoven nature of plants, animals, water, earth, sky, wind, fire and people. Tribes do not compartmentalize natural or cultural resources, as does western science, rather they are interwoven or integrated; the physical and the spiritual world intersect.

In consultation with Tribes culturally affiliated with the BMGR, a review of oral histories, myths, and songs has resulted in the identification of general categories of natural resource that are cultural resources and/or of cultural, religious, or traditional importance. Cultural affiliation studies conducted by Tribes identify specific plants, animals, minerals, and locations on the BMGR that are of importance to them. The Tohono O'odham have identified 36 natural waters, 55 places in the landscape, plants, and animals that are important to them.

What is clear is that the perspective of Tribes, their scientific knowledge (Traditional Ecological Knowledge [TEK]) and the living connection to the land are important for resource managers.. TEK is the evolving knowledge held by indigenous and local cultures about their immediate environment and the cultural practices that build on that knowledge (USFWS 2011) TEK is location specific and includes detailed knowledge of the relationships between plants, animals, natural phenomena, landscapes and timing of events that are used for lifeways, including but not limited to hunting, fishing, trapping, agriculture, and forestry; and a holistic knowledge or "world view" that parallels the scientific discipline of ecology (USFWS 2011). This body of knowledge, practice, and belief, is

continually evolving by adaptive processes and is handed down through generations by cultural transmission about the relationships of living beings (human and non-human) with one another and with the environment (see the USFWS's *Native American Policy* [USFWS 2016]). TEK can cause the cultural or spiritual values of plants, animals, and physical aspects of the landscape to differ significantly from those of resource managers steeped in Western Science. For example, natural surface waters, such as tinajas, are altered to provide water for game animals. Tinajas are archaeological sites based on the presence of grinding features and tools; they are a specific type (Traditional Cultural Property/Place) of Historic Property that is eligible for inclusion in the National Register of Historic Places; and they are Sacred Sites. Tribes have requested that alterations to tinajas or other natural waters be removed and that no new alterations occur in the future.

List of examples related to BMGR:

- Tribes have identified plants and animals that Western Science considers to be endangered species, such as the Sonoran Pronghorn, but to Tribes they are a common game animal.
- Plants and animals that Western Science consider to be common or not of great importance may to Tribes be endangered, threatened, sacred and/or powerful.
- The O'odham have identified Yerba Manza, a medicinal plant, as endangered because it has become rare, while to western science it is common.
- Perhaps, one of the most important animals to the O'odham and other tribes is the coyote
    - In western science, coyotes are a controversial predator but an essential component of the ecosystem.
    - To the O'odham, coyote is one of four primordial beings in the Creation Epic, extremely important, archetype for human characteristics or traits (jokester), plays a role in sickness, plays a role in many stories, and was never eaten.

Integrated resource management requires that cultural and natural resource managers must work closely together. Section 2.7 of the Cultural Resource Playbook, which along with AFMAN 32-7003, Environmental Conservation addresses integration of the INRMP and ICRMP as follows:

- Identify natural resources and properties that are of traditional, religious, or cultural importance to Tribes.
- Identify the cultural values and importance of plants, animals, water, and features of the physical environment, particularly for specific projects and overall land management.
- Ensure that the ICRMP accounts for natural resources that should be managed as cultural resources.
- Ensure that the INRMP accounts for cultural resources that should be managed as natural resources.
- Ensure management of endangered species shall consider the ideas and perspectives of Tribes.
- Ensure that consultation with Tribes explains and depicts consultation and reporting requirements when undertakings or other management actions have the potential to affect protected tribal natural/cultural resources.

- Ensure that DoD policy and the requirement of statutes and regulations are known to cultural/natural staff and factored into the ICRMP and INRMP.

In addition, TEK should be incorporated into resource management plans, projects, and research.

TEK and western science are each a separate body of knowledge that overlap and can be complementary. TEK can be used to guide empirical or experimental studies to learn more about plant-animal interactions. Testing indigenous hypotheses through western scientific processes to identify the relative degree of exclusivity of relationships could result in additional insights of significance to ecological and evolutional theory (Nabhan 2000). A number of these studies have revealed that indigenous knowledge of biotic relationships involving rare plants or animals can help guide the identification, management, protection or recovery of habitat for these species (Nabhan 2000). As such, TEK can help fill the gaps in western science and has a relevant and meaningful role in a government agency's decisions.

The USFWS, in coordination with representatives from tribes across the country, worked together to update the USFWS policy (USFWS 2016), which provides guidance for inclusion of TEK into management decisions. This means using the best available data and soliciting and considering other sources of information, such as the traditional knowledge and experience of affected tribal governments in policies, military actions, and determinations that have tribal implications. To incorporate TEK into its land management decisions, the USFWS Native American Policy states that resource managers should promote enhanced and ongoing communication, cooperation, and trust with tribes and consider the traditional knowledge, experience, and perspectives of Native American people to manage fish, wildlife, and cultural resources (USFWS 2016). Working collaboratively with local tribal governments, government agencies can help to protect confidential or sensitive information, including location, ownership, character, and use of cultural resources and sacred sites where disclosure may cause a significant invasion of privacy; risk harm to the historic resource; or impede the use of a traditional religious site by practitioners, to the extent allowed by law (USFWS 2016).

Although the DoD does not currently have a policy that explicitly directs DoD agencies to incorporate TEK into its management philosophy, there are directives, instructions, and other relevant documents that spell out the need to address concerns and needs of federally recognized American Indian Tribes and keep them in communication loops regarding decisions and actions that could affect their lands, resources, and quality of life. Air Force Policy Directive 30-70 (USAF 1994a), section 3.3, stipulates that, "The Air Force will conserve natural and cultural resources through effective environmental planning." Policy 1.3.1 of AFI 90-2002 (*Air Force Interactions with Federally-Recognized Tribes* [USAF 2015b]) directs the USAF to "Take into consideration the significance that tribes place on protected tribal resources." Policy 1.5.2 of AFI 90-2002 further specifies that, "…since most tribes attribute cultural significance to natural resources, tribes should be briefed on the content of the natural resources program, and provided the opportunity to consult on and participate in, as appropriate, update or development of INRMPs, AFI 32-7064, Natural Resource Management Program in accordance with the Installation Tribal Relations Plan." Involving tribal representatives in decisions regarding natural resource projects, particularly those involving eagles and other protected species, will help to ensure that TEK is taken into consideration. Finally, the USMC

handbook (USMC 2004) for preparing, revising, and implementing INRMPs states that, "Marine Corps installations must consult with federally recognized Indian tribes whose interest may be affected by land management on the installation when preparing an INRMP…. In consultation for the INRMP, American Indian tribes may identify areas and resources present on the installation that are important to the tribe, provide advice on conservation needs and priorities, and share their specialized knowledge of the resources on the installation."

7.15 Public Outreach

As the primary users and managers of BMGR East and West, the USAF and the USMC, respectively, have been delegated several responsibilities. One of these responsibilities is to manage the range in a way that ensures long-term use of the facility as a premier military training location while also ensuring management and protection of natural and cultural resources. In that capacity, the USAF and USMC routinely provide forums for public outreach and opportunities for the public to learn about and provide input on various actions proposed for the BMGR. This section provides an overview of the various public involvement programs and opportunities. Focus areas for public involvement programs are listed below.

- Tours
- Published articles
- Speaking events
- Media coordination
- Special projects and events
- Miscellaneous requests and participation in events

7.15.1 BMGR Executive Council

The BEC includes representatives of federal and state agencies with statutory authority and management responsibility for the range and adjacent federal lands, and the resources on those lands: MCAS Yuma, BLM, USFWS, AGFD, CBP, and directors for the adjacent Sonoran Desert NM, Organ Pipe Cactus NM, and Cabeza Prieta NWR. The BEC is chaired by the Director of the 56 RMO and meets six times a year to share information and discuss and propose solutions to regional issues.

7.15.2 BMGR Intergovernmental Executive Committee

The MLWA of 1999 directed the Secretary of Interior, Secretary of the Air Force, and the Secretary of the Navy to establish an IEC to be comprised of selected representatives from federal, state, local, and tribal governments. The IEC is established solely for the purpose of exchanging views, information, and advice relating to the management of natural and cultural resources of the withdrawn lands. The IEC is chaired by the MCAS Yuma Conservation Manager and is composed of representatives from the USAF, USN, and Department of Interior as well as representatives of other federal, state, county and municipal government agencies and Native American tribes that have interests in BMGR. The IEC meets three times per year in January, May, and September. IEC meetings provide opportunities to educate and seek input from the public and special interest groups on management of BMGR's natural

resources. Meeting dates are announced at the conclusion of each meeting and reminders are emailed to individuals on the IEC's distribution list to provide several months' notice. The IEC meeting minutes are posted on a public website.

BMGR East

Public outreach efforts by the USAF provide input on the development of information and infrastructure improvements to facilitate public recreational activities, as follows.

- Updated public visitation maps and rules for public education and recreation use
- An informational video for visitors that addresses safety and environmental awareness
- Installation of signs, gates, and fences to support road infrastructure and public access
- 56 RMO biologists and archaeologists give presentations for the public as well as at local and national professional meetings

The USAF conducts public meetings on various issues that are announced via its website, newsletters, mailings, newspaper advertisements or legal notices, and other means. The Luke AFB maintains a web page containing information for BMGR East public outreach opportunities (http://www.luke.af.mil/News/).

Public participation has increased from the previous years for all of the activities listed above. Ongoing exercises and operations continue to generate media interest both at Gila Bend AFAF and the BMGR. Requests for speakers, briefings, appearances, and tours continue to grow, along with requests for participation in town, county, and state meetings, to coordinate efforts and share information.

BMGR West

Public outreach efforts by the USMC have included improving information and infrastructure to facilitate public recreational activities at the BMGR West, as follows.

- A bird checklist is available for birding enthusiasts.
- A public brochure and map with details on road access retained for public access and range rules (e.g., rules for camping, off-road vehicle travel, rock hounding, firewood collection, hunting, native plant or wood collection, mine entry, recreational shooting, and trash disposal) are made available to the public.
- Signs, gates, and fences have been installed to support road infrastructure and public access.
- Tours of various BMGR West features or resources, such as the Fortuna Mine, are offered.
- Meetings are held with local non-governmental groups, such as the Yuma Valley Rod and Gun Club, to issue recreation access permits.
- RMD staff visit local recreational vehicle parks to educate seasonal visitors about the BMGR West recreational program.

The CLEOs are primarily responsible for MCAS Yuma's public outreach efforts because they patrol the range seven days a week. In addition, visitors are provided with a brochure that includes a detailed map of road classification (i.e., public, closed, administrative access) and a list of approved and prohibited recreational activities (e.g., camping, off-road vehicle travel, rock hounding, hunting). Guided range tours (e.g., mine tours) can be scheduled through the RMD staff. Finally, the RMD promotes public outreach by supporting research opportunities, publication of research results in peer reviewed journals, and researcher participation in science conferences and symposiums.

7.16 Climate Change Vulnerabilities

Climate vulnerability in this case refers to the degree to which an installation and its natural resources are susceptible to shifts in the environment due to climate change. At the BMGR, the climate is projected to become warmer, with alterations in the magnitude and seasonality of precipitation (see Section 2.2.1.2). The range may be susceptible to the following climate-related issues:

- Shifts in the **ecosystem and biotic environment**, including possible expansions of invasive vegetation (Section 2.3.2), loss of native vegetative cover (Section 2.3.2), and reduced water availability and quality for wildlife during the summer drought (Section 2.3.3)
- Indirect threats to the **mission**, including more frequent equipment and infrastructure maintenance requirements due to increased windspeed/dust, greater summer drought potential due to warmer temperatures, and a potentially enhanced regulatory environment (Section 2.4.5.1)
- Shifts in habitat quality for both invasive/nuisance species and native species, potentially requiring additional **wildlife management** activities (Section 7.1.2)
- Additional threats to **threatened and endangered species**, including lower water availability, greater heat stress, and shifts in phenology (Section 7.4)
- Increased **wildland fire** activity, especially if invasive grasses continue to expand (Section 7.9)

The best available science was used to develop the global climate models from which the downscaled projections and related climate vulnerability assessments were derived. However, there are gaps in data about the complex feedbacks in this system, which add uncertainty to the climate projections (IPCC 2014). The projections provided in this document are therefore intended to demonstrate the range of conditions to which natural resource managers may have to adapt.

7.17 Geographic Information Systems (GIS)

GIS is used in daily operations as the data support for the natural and cultural resource and environmental stewardship programs. Over the next five years, geospatial data will be updated periodically and several new types of GIS data will be acquired including, but not limited to, the following actions.

- Further refining and delineating important wildlife habitats and corridors
- Monitoring and tracking sensitive and endangered wildlife and plant species

- Monitoring and managing habitat disturbance and restoration efforts
- Monitoring and tracking invasive species and reporting control effort results
- Monitoring and tracking trespass livestock and monitoring impacts associated with their presence
- Analyzing projects for NEPA compliance and storing data for regulatory reporting
- Updating the transportation road layer including delineating new unauthorized routes
- Identifying and monitoring cultural resource sensitivity zones
- Completing the BMGR East range wide vegetation mapping effort and completing integration and edge matching with other similar regional vegetation mapping products (i.e., Malusa 2003)
- Monitoring and delineating drag road impacts and prioritizing areas for restoration and maintenance.
- Updating infrastructure layers as the military training mission changes and as the BP's mission is modified.

BMGR East

USAF Instruction 32-10112, *Installation Geospatial Information and Services* (USAF 2007), provides the policy and guidance for GIS management on all USAF installations including. Geospatial data are maintained and managed by the 56 RMO Environmental Science and Management Office. The GIS server resides in the 56th Communication Squadron Network Communication Center and on the NIPRNet. Additionally, the geospatial data are maintained within the USAF GeoBase System and services are provided through the GIS database that is centrally located on the server. The BMGR East GIS program currently utilizes software from ESRI (Environmental Systems Research Institute) for GIS data management and use. The 56 RMO and 56th Civil Engineer Squadron adhere to the Spatial Data Standards for Facilities, Infrastructure, and Environment, as required by the DoD, to provide GIS standardization for table structure, metadata, and data storage among all DoD installations.

BMGR West

USMC MCO 11000.25a, *Installation Geospatial Information and Services Program* (USMC 2013a), also referred to as USMC Installation Geospatial Information and Services (GEOFidelis), provides the policy, guidance, and standards for acquiring, protecting, and utilizing geospatial data and GIS data management in support of USMC installations. Geospatial data are maintained and managed by the MCAS Yuma RMD within the USMC GEOFidelis System. The GEOFidelis program goal is to ensure that USMC installation geospatial data are complete, accurate, current, and available as a USMC-wide resource. The MCAS Yuma RMD and MCAS Yuma Civil Engineer/GIS Department adheres to the Spatial Data Standards for Facilities, Infrastructure, and Environment, as required by the DoD, to ensure GIS standards are used for table structure, metadata, and data storage among all DoD installations.

CHAPTER 8 MANAGEMENT GOALS AND OBJECTIVES

The installation establishes long term, expansive goals and supporting objectives to manage and protect natural resources while supporting the military mission. Goals express a vision for a desired condition for the installation's natural resources and are the primary focal points for INRMP implementation. Objectives indicate a management initiative or strategy for specific long or medium range outcomes and are supported by projects. Projects are specific actions that can be accomplished within a single year. Also, in cases where off-installation land uses may jeopardize USAF or USMC missions, this section may list specific goals and objectives aimed at eliminating, reducing, or mitigating the effects of encroachment on military missions. These natural resources management goals for the future have been formulated by the preparers of the INRMP from an assessment of the natural resources, current condition of those resources, mission requirements, and management issues previously identified. Below are the integrated goals for the entire natural resources program.

The installation goals and objectives are displayed in the 'Installation Supplement' section below in a format that facilitates an integrated approach to natural resource management. By using this approach, measurable objectives can be used to assess the attainment of goals. Individual work tasks support INRMP objectives. The projects are key elements of the annual work plans and are programmed into the conservation budget, as applicable.

Installation Supplement – Management Goals and Objectives

Management policy (MP) goals reflect the values and desired future condition of natural resources; thus, they serve as the focal points for implementing the INRMP. MP goals are not resource-specific, but they are consistent with the military mission for protecting and conserving natural and cultural resources and public access to BMGR. This section identifies management issues and establishes management responsibilities, implementation schedules, and funding requirements for each of the five established natural resource management goals. Both the MP and resource-specific (RS) management goals have range-wide application. In no implied order of importance, the five management policy (MP) goals are listed below.

MP1. Maintain and enhance natural resources to ensure that these resources are sustained in a healthy condition for compatible uses (e.g., low-impact recreation) by future generations while supporting the existing and future military purposes of the BMGR.

MP2. Manage cultural resources in accordance with the BMGR ICRMP.

MP3. Provide for public access to BMGR resources for sustainable, multi-purpose use, consistent with military purposes of the range (including security and safety requirements) and ecosystem sustainability.

MP4. Apply ecosystem management principles through a goal-and-objective-driven approach that recognizes social and economic values; is adaptable to complex, changing requirements; and is realized through effective partnerships among private, local, state, tribal, and federal interests.

MP5. Meet or exceed the statutory requirements of the MLWA of 1999, Sikes Act, and other applicable resource management regulatory requirements.

The RS goals address earth, water, vegetation, wildlife, and visual resources; transportation; recreation; Native American access; non-military and perimeter land use; and special natural/interest areas. RS goals aligned with MP2 are included in the ICRMP and do not appear in the INRMP. The RS goals are presented in Table 8-1 (in no implied order of importance).

Table 8-1: Resource-specific management goals.

Resource-Specific (RS) Goal No.	Resource Management Category	Management Goal(s)
RS1	Earth Resources	Subject to budgetary constraints, implement best-management practices to control and prevent soil erosion, implement soil conservation measures, and restore or rehabilitate degraded landscapes wherever practicable, subject to budgetary constraints.
RS2	Water Resources	Manage water resources to protect, maintain, and improve water quality; conserve water to prevent lowering of the water table levels; and ensure compliance with regulatory requirements while maintaining unrestricted access for military purposes.
RS3	Vegetation Resources	Protect and conserve plant communities and species diversity. Identify, protect, conserve, manage, and comply with regulatory requirements for threatened and endangered species or other important or sensitive species. Continue to inventory the range for occurrence and distribution of exotic species and implement management measures for their removal or control. Restore or rehabilitate altered or degraded plant communities wherever practicable, subject to budgetary constraints. Continue to incorporate the principles of ecosystem management and promote biodiversity.
RS4	Wildlife Resources	Protect and conserve wildlife habitat, species diversity, and viable populations. Identify, protect, conserve, manage, and comply with regulatory requirements for federally threatened and endangered wildlife species or otherwise significant or sensitive species. Restore or rehabilitate human-altered or degraded wildlife habitats wherever practicable, subject to budgetary constraints. Continue to incorporate the principles of ecosystem management and promote biodiversity. Monitor and control trespass animals and livestock and assess and mitigate their impacts.
RS5	Visual Resources	Protect or enhance the integrity and diversity of visual resources (including scenic qualities of the landscape).

Table 8-1: Resource-specific management goals.

Resource-Specific (RS) Goal No.	Resource Management Category	Management Goal(s)
RS6	Transportation	Continue to implement the transportation plan that addresses continued land-based access for military training and testing; provides access for wildlife research and wildlife habitat management, land management, and law enforcement by federal and state agencies; and provides access for wildlife-oriented recreation and sustainable multipurpose use by the public, including access to sacred sites and traditional cultural places. Implement established policies and procedures that ensure that vehicle will be controlled and directed so as to protect resources, promote safety, and minimize conflicts among the various uses of the range.
RS7	Recreation	Provide for public access and use of land and natural resources for sustainable multi-purposes when such activities are compatible with mission activities and other considerations such as security, safety, and resource sensitivity. Manage all activities in accordance with the ICRMP.
RS8	Native American Access	Provide for Native American access to Traditional Cultural Places, Sacred Sites, and protect resources which include plants, clay, minerals, etc. Tribes may hunt with a valid AGFD permit.
RS9	Non-Military Land Use	Maintain a program for addressing rights-of-way. Participate in local initiatives to advance eco-regional planning and biodiversity goals.
RS10	Perimeter Land Use	Cooperate with land managers of adjoining property for conservation, public relations, and compliance benefits. Develop strategies, in coordination with ranchers when feasible, to reduce trespass livestock occurrences.
RS11	Special Natural/ Interest Areas	Recognize existing special resources and/or areas in which special resources are identified; consider the applicability of special management provisions for the protection of these areas.

CHAPTER 9 INRMP IMPLEMENTATION, UPDATE, AND REVISION PROCESS

9.1 Natural Resources Management Staffing and Implementation

The Sikes Act encourages the DoD to provide adequate staffing with the appropriate expertise for updating, writing, and implementing the INRMP within the scope of DoD component responsibilities, mission and funding requirements.

BMGR East

The 56 RMO/ESM includes archaeologists, wildlife biologists, geographers, and environmental planners. The 56 RMO/ESM support military training by managing the natural and cultural resources of the range in accordance with applicable laws, EOs, and directives (CRP, in prep.). The 56 RMO/ESM also provides Contracting Officer's Representative oversight of the pronghorn monitoring function of the range operations contract, and ESM staff serves as the Contracting Officer's Technical Representative on contracts for cultural resources and other services.

BMGR West

The MCAS Yuma RMD staff are experts in the fields of natural and cultural resources management and conservation law enforcement. The staff is devoted to providing the resources and expertise in the planning and implementation of advanced training and exercises while fulfilling the goals and objectives of this INRMP.

In August 2015, a cooperative agreement was signed between the USACE Omaha District and the AGFD (USACE and AGFD 2015) to "collect, analyze, and apply environmental and cultural resource data and implement land rehabilitation and maintenance for optimal management of lands under control of the DoD…" (USACE 2015). The cooperative agreement provides the DoD assistance for executing prescribed tasks to implement the goals and objectives of the INRMP.

9.2 Monitoring INRMP Implementation

The BMGR's natural resource management has been mostly limited to actions taken for the benefit of protected or special status species (e.g., Sonoran pronghorn, acuña cactus, and FTHL). This revised INRMP continues to rely heavily on the most current biological data sets, general and species-specific wildlife surveys, research projects, and regional data sets.

Over the next five-year period, factors upon which this INRMP is based on may change, including military mission requirements, federal list of threatened and endangered species, information available for listed species and their ecosystems, as well as the understanding of anthropogenic impacts on resources. The implementation of this INRMP, will follow an adaptive management approach that acknowledges uncertainty and monitors the various INRMP components and lessons learned with the end goal of improving the BMGR's future management actions and ecosystem health.

9.3 Annual INRMP Review and Update Requirements

DoD guidance provides that the annual review shall verify that

- the current information on all conservation metrics is available;
- all "must fund" projects and activities have been budgeted for and implementation is on schedule;
- all required, trained natural resource positions are filled or are in the process of being filled;
- projects and activities for the upcoming year have been identified and included in the INRMP (an updated project list does not necessitate revising the INRMP); and
- all required coordination has occurred.

All significant changes to the installation's mission requirements or its natural resources have been identified. The USAF and USMC will review the progress made in implementing the INRMP annually with AGFD and USFWS at the regularly scheduled BEC meetings and with other partners and the public at the annual IEC meetings in the fall. The USAF and USMC will track their own progress using appropriate metrics but common elements are to be reported by both. They will include funded/unfunded projects; coordination and feedback from cooperating agencies, military trainers, and range operators; timeframes for implementing projects; deliverables for complying with Biological Opinions; and attainment of project-specific objectives. The effectiveness of management guided by the INRMP also will be gauged annually by tracking the degree to which each implementation project makes progress toward attaining the resource management goals established in the INRMP. The INRMP resource management goals are presented in Chapter 8 *Management Goals and Objectives*. Current implementation projects and the resource management goal(s) addressed by each project are identified in Chapter 10 *Annual Work Plans*.

9.3.1 INRMP Update and Revision Process

This INRMP update identifies proposed amendments to the 2012 INRMP and changes to natural and cultural resources management practices that would be implemented during the subsequent five-year period. This INRMP revision is available to the public, state and local governments, and Native American tribes on the Luke AFB and MCAS Yuma websites.

This is the second update of the original 2007 BMGR INRMP prepared in support of an ongoing process to review and update the INRMP every five years. This 2018 update INRMP was prepared in accordance with the MLWA of 1999, which provides that periodic reviews of the BMGR INRMP be conducted jointly by the Secretaries of the Navy, Air Force, and Interior, and that affected states and Native American tribes, as well as the public, are provided a meaningful opportunity to comment upon any substantial changes to the INRMP (Public Law 106-65 § 3031(b)(3)(E)(ix)). As part of the update process, a Public Report was distributed to describe the changes in military use, environmental conditions, and public access opportunities that have occurred since the 2012 INRMP update. The report also provides an account of the resource management and public involvement activities that have transpired during the same period. This updated INRMP includes information based on the comments received on the Public Report and responses to those comments. The next review and update of the BMGR INRMP is currently scheduled for 2023. A Public Report chronicling

changes at BMGR during each five-year review cycle will be issued concurrent with each subsequent revision.

If warranted, proposed management decisions regarding INRMP amendments and changes to management practices will be reviewed under the auspices of NEPA before being implemented. For this current INRMP update, no changes have been identified that warrant the preparation of a NEPA document.

In 2020, certain sections of the INRMP were updated to incorporate a climate change assessment (CEMML 2019), but neither the annual update nor the 5-year review was completed at this time.

CHAPTER 10 ANNUAL WORK PLANS

The INRMP Annual Work Plans are included in this section. These projects are listed by fiscal year, including the current year and four succeeding years. For each project and activity, a specific timeframe for implementation is provided (as applicable), as well as the appropriate funding source and priority for implementation. The work plans provide all the necessary information for building a budget within the USAF an USMC frameworks. Priorities are defined as follows:

- High: The INRMP signatories assert that if the project is not funded the INRMP is not being implemented and the USAF is non-compliant with the Sikes Act; or that it is specifically tied to an INRMP goal and objective and is part of a "Benefit of the Species" determination necessary for ESA Sec 4(a)(3)(B)(i) critical habitat exemption.
- Medium: Project supports a specific INRMP goal and objective and is deemed by INRMP signatories to be important for preventing non-compliance with a specific requirement within a natural resources law or by EO 13112, *Exotic and Invasive Species*. However, the INRMP signatories would not contend that the INRMP is not being implemented if not accomplished within the programmed year due to other priorities.
- Low: Project supports a specific INRMP goal and objective, enhances conservation resources or the integrity of the installation mission, and/or supports long-term compliance with specific requirements within natural resources law; but is not directly tied to specific compliance within the proposed year of execution.

In this 2018 update of the INRMP, the USAF and USMC have developed lists of actions planned for implementation during the next five years. The 17 management elements (see Chapter 7) are listed below and referenced by number in the left column of Table 10-1 and Table 10-2.

1. Resource inventory and monitoring
2. Special natural/interest areas
3. Motorized access and non-roaded area management
4. Camping and visitor stay limits
5. Recreation services and use supervision
6. Rock hounding
7. Wood cutting, gathering, and firewood use; and collection of native plants
8. Hunting
9. Recreational (target) shooting
10. Utility/transportation corridors
11. General vegetation, wildlife, wildlife habitat, and wildlife water
12. Special status species
13. Soil and water resources
14. Air resources
15. Visual resources

16. Wildfire management
17. Perimeter land use, encroachment, and regional planning

See Appendix B for the status of action items, listed by management element, proposed in the 2012–2017 INRMP for BMGR East and West.

The 17 management elements have been categorized into five general types of actions.

1. Resource management—includes continuing the implementation of the natural resources inventory and monitoring plans
2. Motorized access—includes archaeological surveys of the road network and modifications of the existing road network to better meet management needs that have been identified in the past five years, as described in Chapter 4, and continuing programs to direct the public to use roads remaining open to public access
3. Public use—includes several management elements for providing recreational opportunities while protecting resources
4. Manage realty—includes addressing the public utility and transportation corridors that pass through the range, and managing new right-of-way requests
5. Perimeter land use—involves monitoring land uses beyond the range to prevent encroachment, and working with other agencies in regional planning

In some cases, the USAF and USMC propose the same or similar processes and may work together for range-wide applications. In other cases, the issues associated with the BMGR East and West, will differ. Several projects will require an interagency effort in which the DoD will work with the partner agencies involved in the INRMP or other agencies, as appropriate.

Table 10-1 and Table 10-2 provide the USAF and USMC actions plans. Each table includes the 17 management elements being addressed (see Chapter 7), as well as the funding year, action frequency, and the partners likely to be involved. Before proposed action steps, priorities, funding requirements, or other factors for the next five years are finalized, range managers will consider the public input, consultations with Native Americans, and any additional partner agency feedback. These lists will be reviewed annually to evaluate progress completed and to adapt the lists, when appropriate, to address emerging issues, changing priorities, availability of funds, or other issues.

10.1 Annual Implementation

Table 10-1: BMGR East 5-Year Action Plan FY 2019–2023.

INRMP BMGR East 5-Year Work Plan: FY 2019–2023											
Element[1]	**Action Step[2]**	**Fiscal Year[3]**	**Funding[4]**	**Frequency[5]**	**Partners[6]**	**Comments**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**
Resource Management											
1, 11	Monitor and control invasive species	Annual	$50,000	Annual	In-house, Interagency, University	Ongoing monitoring occurs while driving range roads, control measures performed when necessary and appropriate.	$50,000	$50,000	$50,000	$50,000	$50,000
1	Monitor vegetation plots in several plant communities	Annual	$60,000	Annual	In-house, Contractors, Interagency	Each plot is assessed at 5-year intervals.	$10,000	$10,000	$10,000	$10,000	$10,000
1	Desert tortoise surveys	1 & 5	$50,000	Every 5 years	AGFD	Survey new areas and or re-survey known occupied and suitable habitat identified during previous surveys.	$50.000				$50,000
1	Raptor management surveys and monitoring	Annual	$15,000	Annual	In-house, AGFD	Support bald eagle nest watch, golden eagle surveys, raptor surveys, assess potential for powerline electrocution, etc.	$15,000	$15,000	$15,000	$15,000	$15,000
1	Bird surveys	1 & 2	$35,000	Varies	In-house, AGFD	New protocol by Arizona Bird Conservation Initiative; survey 3 consecutive years, pause 5 to 10 years, repeat.			$35,000	$35,000	$35,000
1	Support AGFD surveys for game ungulates	Varies	$-	Varies by species	AGFD	Support and participate in surveys performed by AGFD.					
1	Support AGFD surveys for gamebirds	Annual	$-	Annual	AGFD	Support and participate in surveys performed by AGFD.					
1	Collaborate with AGFD to identify and maintain important wildlife connectivity corridors	Annual	$-	Annual	AGFD	Collaborate with AGFD to identify and maintain important wildlife connectivity corridors.					
1	Kit fox population monitoring	1 & 4	$5,000	Every 3 years	In-house	Continuation of population monitoring using scent stations.	$5,000			$5,000	
1	Bat surveys; evaluate, monitor and protect important bat roosts	Annual	$50,000	Annual	In-house, AGFD	Various survey techniques: acoustic monitoring, mist netting, roost assessments, guano sampling, etc.	$25,000	$25,000	$25,000	$25,000	$25,000
1	Cactus ferruginous pygmy-owl survey (low priority)	1, 3, & 5	$5,000	Every 2 years	In-house	Low priority: none detected on BMGR East during repeated surveys over past 20 years; marginal habitat.	$3,000		$3,000		$3,000
1	Weather stations and rain gauges	Annual	$19,000	Annual	In-house	Operate 12 existing remote-access stations, plus 15 rain gauges at specific study locations.	$19,000	$19,000	$19,000	$19,000	$19,000
1	Monitor use of wildlife watering sites	Annual	$15,000	Annual	In-house, AGFD	Continuation of program using wildlife cameras to record usage during summer months; evaluate resulting thousands of photographs to build database of species, abundance, location, etc.	$15,000	$15,000	$15,000	$15,000	$15,000
1	Medium and low priority actions as resources allow	Annual	$10,000	Varies	TBD	Some lower-priority actions may be completed based on adaptive management concerns or availability of resources.	$10,000	$10,000	$10,000	$10,000	$10,000
1	Vegetation mapping	3 & 5	$25,000	Annual	In-house, Interagency, University	Continuation of vegetation mapping project being performed by UA; uses standardized method in use by regional land managers.			$25,000		$25,000

Table 10-1: BMGR East 5-Year Action Plan FY 2019–2023.

INRMP BMGR East 5-Year Work Plan: FY 2019–2023											
Element[1]	**Action Step[2]**	**Fiscal Year[3]**	**Funding[4]**	**Frequency[5]**	**Partners[6]**	**Comments**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**
1	Acuña cactus monitoring	Annual	$50,000	Annual	In-house, AGFD, Contractor	Continuation of Acuña Cactus monitoring, distribution surveys, habitat modeling, etc.	$50,000	$50,000	$50,000	$50,000	$50,000
1	Support special studies to address specific management issues, such as invasive species, species of concern, climate change, etc.	Annual	Varies	Annual	In-house, Interagency, University	Supports research proposals developed by universities, AGFD, USGS, or others that address various issues of concern.	$19,000	$27,000	$34,000	$37,000	$19,000
1	Implement cultural resource survey and monitoring requirements for INRMP-related actions	2, 5	$150,000	Annual	In-house, Contractors	Continue surveys along roadways and nearby potential cultural sites in Area B, including recording of camp sites; use resulting information to assess potential adverse effects from INRMP-related activities including motorized access and public use.		$150,000		$150,000	
2	Identify and evaluate other possible Special Natural/Interest Areas	3	$20,000	One time	In-house	Bender Spring and Crater Range are candidate areas; Crater Range and Sentinel Plains Lava Flow were previously designated as Special Recreation Management Areas by the BLM but allowed to expire due to conflicts with military use (see 2007 INRMP for more information); also contemplating a nature trail in Crater Range.			$20,000		
11	Habitat restoration*	As needed	$25,000	Annual	In-house	Active and passive restoration of degraded areas	$25,000	$25,000	$25,000	$25,000	$25,000
11	Evaluate benefits and adverse effects of wildlife watering sites	Annual	$35,000	Annual	In-house, Interagency, University	Perform a holistic review based on previous studies at BMGR and relevant literature, continue water-quality monitoring and develop recommendations for management.	$35,000	$35,000	$35,000	$35,000	$35,000
1	Develop and implement procedures to control trespass livestock	Annual	$55,000	Varies	In-house	Address burgeoning trespass livestock population.	$5,000	$5,000	$5,000	$5,000	$5,000
11	Allow for the maintenance and repair of existing water developments*	As needed	TBD	Reoccurs as needed	AGFD	Support AGFD annual maintenance of all waters and redevelopment as required.					
12	Participate and implement actions per the Sonoran Pronghorn Recovery Plan	Annual	$220,000	Recurring actions	Interagency	Pronghorn recovery actions as stipulated in the Biological Opinion, recovery plan, or as determined by the interagency Recovery Team.	$220,000	$220,000	$220,000	$220,000	$220,000
13	Evaluate erosion conditions of range roads; repair or temporarily restrict use*	Annual	$-	Annual	In-house, Contractor	Annual driving inspection of the most heavily used range roads; secondary and tertiary roads driven at least every 3 years; continue drag road monitoring at 10 sites.					
13	Evaluate erosion problems in specific areas, develop recommendation plans for repair	3	$150,000	One time	Interagency, University Contractor	Road maintenance practices in many areas are non-sustainable.			$150,000		
13	Monitor water table levels	Annual	$-	Annual	In-house	Performed by range operations contractor.					

Table 10-1: BMGR East 5-Year Action Plan FY 2019–2023.

INRMP BMGR East 5-Year Work Plan: FY 2019–2023											
Element[1]	**Action Step[2]**	**Fiscal Year[3]**	**Funding[4]**	**Frequency[5]**	**Partners[6]**	**Comments**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**
14	Control excessive fugitive dust at permitted construction sites and recreation activity areas	As required	$-	TBD	In-house	Performed by range operations contractor as part of recurring maintenance work.					
16	Complete and implement fire management plan	Annual	$-	One time	In-house	Assess fire risk, implement campfire restrictions as appropriate; maintain firefighting agreement with BLM.					
Motorized Access											
3	Close selected roads to public access where an agency mission or resource protection issues conflict with public use	As required	TBD	As required	In-house	Access restrictions may be imposed due to evolving weapons-safety footprints, natural or cultural resource protection, law enforcement concerns or other management actions.					
Public Use											
4	Assess benefits and effects of establishing designated camping areas and implement a decision based on the findings	Year 5	$-	One-time	In-house	Not enough information available to make an assessment; existing camp sites are being recorded as part of cultural resources surveys along road corridors.					
5	Revise public visitation maps and rules for public education and recreation use; would inform the public about road restrictions and resource sensitivities	Annual	$3,000	Annual	In-house, USMC	Annual revisions based on results of area monitoring, with clarifications of rules printed on the reverse sides of the maps.	$3,000	$3,000	$3,000	$3,000	$3,000
5	Public outreach	Annual	$5,000	Annual	In-house	Supports public awareness projects to educate base personnel/public about BMGR cultural resources, natural resources, historic preservation, and conservation activities.	$5,000	$5,000	$5,000	$5,000	$5,000
5	Public Use Area Access Program	Annual	$7,000	Annual	Contractor	Continue using iSportsman for BMGR East public use area access; compile recreation-use statistics, analyze patterns, and identify heavily used areas, and monitor those areas to identify any resource concerns; use vehicle traffic counters to quantify intensity of use at general and specific areas.	$7,000	$7,000	$7,000	$7,000	$7,000
5	Law enforcement patrol	Annual	$-	Annual	AGFD	First CLEO started October 2017; second officer scheduled to arrive November of FY 2019; both CLEOs shall patrol BMGR East and assist with resource protection.					
5	Install signs, gates, and fences to support road infrastructure and public access	Annual	$5,000	Reoccurs as needed	In-house	Install and maintain signage at range entry points, along perimeters, and at all road intersections.	$5,000	$5,000	$5,000	$5,000	$5,000
7	Monitor native wood supplies in high-use areas; restrict wood collection if resource conditions dictate	Year 1	$-	Recurs every 5 years	In-house	Use completed cultural resources surveys in Area B to identify high-use areas; assess in Year 1.					

Table 10-1: BMGR East 5-Year Action Plan FY 2019–2023.

INRMP BMGR East 5-Year Work Plan: FY 2019–2023											
Element[1]	**Action Step[2]**	**Fiscal Year[3]**	**Funding[4]**	**Frequency[5]**	**Partners[6]**	**Comments**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**
Manage Realty Property											
10	Cooperate with Arizona Department of Transportation (ADOT), BLM, BP, and utility companies regarding proposed actions within existing utility/transportation corridors	Ongoing	$-	As required	ADOT, BLM, BP	Continue dialogue and partnership with proponent and supporting action agencies.					
10	Coordinate with CE Real Property for maintenance of utilities by responsible agencies in the State Route 85 easement	Ongoing	$-	As required	In-house	Activities within the right-of-way include operation and maintenance of overhead power lines, buried fiber optic lines, and a Border Patrol checkpoint.					
Perimeter Land Use											
17	Participate in local and regional planning and monitoring land use patterns	As required	$-	As required	In-house, Interagency	Participate in developing or reviewing environmental assessments or impact statements, resource management plans; serve as DoD clearinghouse for energy development proposals in Arizona.					
17	Monitor illegal immigration, trafficking, and border-related law enforcement to anticipate how BMGR resources may be affected	Ongoing	$-	Annual	In-house, Interagency	Continue informal coordination with law enforcement authorities and gather anecdotal evidence of border-related impacts.					
						BUDGET TOTALS BY YEAR ($)	**576,000**	**676,000**	**766,000**	**726,000**	**631,000**

[1] INRMP Resource Management Element addressed.
[2] Fulfill requirement of Resource Management Element.
[3] Year of funding and completion of action.
[4] Estimate of required funding amount to complete project.
[5] How often action will occur.
[6] Responsible parties for completing the action.
*May require further NEPA review and/or Section 106 consultation.

Table 10-2: BMGR West 5-Year Action Plan FY 2019–2023.

INRMP BMGR West 5-Year Work Plan: FY 2019–2023											
Element[1]	**Action Step[2]**	**Fiscal Year[3]**	**Funding[4]**	**Frequency[5]**	**Partners[6]**	**Comments**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**
Resource Management											
1, 12,	FTHL occupancy surveys	Annual	Varies	Annual	In-house, Interagency	Support AGFD in conducting demographic and occupancy surveys as outlined in the Rangewide Management Plan developed by the FTHL Interagency Coordinating Committee.	$76,500	$78,030	$79,591	$81,182	$82,806
1	Identify and monitor vegetation plots in several plant communities	TBD	Varies	Annual	In-house	Each plot will be assessed at 5-year intervals.					
1, 11	Monitor and control invasive plant species	Annual	Varies	Annual	In-house, Interagency	Annual monitoring and control of invasive plant species is on-going.	$42,148	$43,458	$44,419	$45,307	$46,203
1	Reptile, small mammal, and amphibian surveys and monitoring	2018	Varies	Every 5 years	In-house, Interagency	Establish a repeatable baseline monitoring methodology that will capture the diversity of small mammals, reptiles, and amphibians; develop potential distribution maps captured wildlife; provide recommendations to monitoring efforts and natural resource stewardship.	$200,000				
1	General bird surveys	TBD	Varies	Every 5 years	In-house, Interagency	New protocol under development.					
1	Surveys for game ungulates	TBD	Varies	Varies by Species	In-house, Interagency	Support and participate in surveys performed by AGFD.					
1	Bat surveys	Annual	In-kind	Annual	In-house, Interagency	Assist AGFD in conducting bat surveys at BMGR-West.					
1	Maintain important wildlife connectivity corridors at BMGR West	Annual	Varies	Varies	In-house, Interagency	Collaborate with AGFD and partner agencies to identify and maintain important wildlife connectivity corridors at BMGR West.					
1	Install and maintain weather stations and rain gauges	TBD	Varies	Varies	In-house	Upgrade existing weather stations to wireless communication with Luke AFB.	$30,000				
1	Medium and low priority actions as resources allow	Annual	Varies	Varies	TBD	Some lower-priority actions may be completed based on adaptive management concerns or availability of resources.					
1	Support special studies to address specific management issues, such as invasive species, species of concern, climate change, etc.	Annual	Varies	Annual	In-house, Interagency	Supports research proposals developed by universities, AGFD, USGS, or others that address various issues of concern.					
2	Identify and evaluate other possible Special Natural, Interest Areas	Varies	Varies	As needed	In-house	No special interest areas have been proposed since the 2007 INRMP.					
1, 12	Participate in and implement actions per the Sonoran Pronghorn Recovery Plan	Annual	Varies	Annual	In-house, Interagency	Support Sonoran pronghorn recovery actions as stipulated in the Biological Opinion, Recovery Plan, or as determined by the interagency Recovery Team.	$93,050	$94,817	$96,618	$98,453	$100,323
13	Examine available engineering management practice that can mitigate erosion	Varies	Varies	One-time	In-house, Interagency	Evaluate possible engineering strategies and designs to prioritize areas most erosion mitigation efforts.					
11	Partner with the BP to identify and implement habitat restoration	Varies	Varies	Annual	In-house, Interagency	Collaborate with local BP offices to implement maintenance and repair best-management practices as outlined in CBP's 2012 Environmental Assessment (Department of Homeland Security, U.S. Customs and Border Protection, and U.S. Border Patrol 2012).					

Table 10-2: BMGR West 5-Year Action Plan FY 2019–2023.

INRMP BMGR West 5-Year Work Plan: FY 2019–2023											
Element[1]	**Action Step[2]**	**Fiscal Year[3]**	**Funding[4]**	**Frequency[5]**	**Partners[6]**	**Comments**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**
16	Complete and subsequently implement fire management plan	One-time	Varies	One-time	In-house, Interagency	Contract has been awarded and the fire plan is scheduled for completion in 2018.	$15,682				
1	Range-wide soil map	Years 1,2,3	Varies	One-time	In-house, Interagency	Soil map is being developed.	$150,000				
1	Aerial imagery for range and base	Year 3	Varies	As needed	In-house, Interagency	Imagery will be collected via piloted and/or autonomous aircraft and/or satellites.			$125,000		
1	Characterize anthropogenic impacts	Year 3	Varies	As-needed	In-house, Interagency	Use the best imagery, soil, precipitation, and vegetation data available to map recent disturbances that will considerably improve the series of erosion models.					
1	Construct adaptive management strategies for maintaining acceptable limits of change	TBD	Varies	As Needed	In-house, Interagency	Consider existing baseline survey data and regional concerns to determine the need for the implementing of adaptive management strategies.					
14	Control excessive fugitive dust at permitted construction sites and recreation activity areas	As-required	Varies	As Required	In-house	Control fugitive dust as required through NEPA.					
1	Allow maintenance and development of existing water sources supporting wildlife	As Needed	In-kind	As Needed	Interagency	Continue to work with AGFD to monitor and maintain existing network.					
1, 11, 13,14 ,15	Conduct habitat restoration efforts for damaged areas	As Needed	Varies	As Needed	In-house	Continue active and passive restoration of degraded areas.					
1, 11	Support AGFD installation of up to six high-priority wildlife watering sites at BMGR	As Needed	In-kind	As Needed	In-house, Interagency	Determine as needed and as funding is available.					
1-17	Maintain an adequately trained staff to accomplish conservation goals and objectives	As Needed	TBD	As Needed	In-house	Ensure that sufficient numbers of professionally and adequately trained natural resource management personnel and conservation law enforcement personnel are available and assigned responsibility to manage their installations' natural resources.	$20,400	$20,808	$21,224	$21,684	$22,081
Motorized Access											
1, 5, 6, 7, 8, 9, 11	Develop a plan for determining the limits-of-acceptable change for recreational, natural, and cultural resources	TBD	Varies	As Needed	In-house, Interagency	Use baseline survey data to determine the degree of change and develop a plan appropriate to the findings.					
3	Close selected roads to public access where an agency mission or resource protection issues conflict with public use	TBD	Varies	As Needed	In-house, Interagency	Determine as needed and as funding is available.					
3	Evaluate site-specific proposals to assess the need for and potential impacts of approving additional roads for agency purposes	As Needed	TBD	As Needed	In-house	Determine as needed.					
3, 5	Install signs, gates, and fences to support road infrastructure and public access	As Needed	TBD	As Needed	In-house	Install signs as needed to identify restricted areas, range boundaries, range entry points, along perimeters, road intersections, and ground support areas.					

Table 10-2: BMGR West 5-Year Action Plan FY 2019–2023.

INRMP BMGR West 5-Year Work Plan: FY 2019–2023											
Element[1]	**Action Step[2]**	**Fiscal Year[3]**	**Funding[4]**	**Frequency[5]**	**Partners[6]**	**Comments**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**
Public Use											
4, 5	Maintain the recreational use database to determine public use, roads, and compliance in support of natural resource management actions	Annual	Varies	Annual	In-house	Permits office maintains records of range permits issued monthly.					
4	Assess benefits and effects of establishing designated camping areas for adaptive management of public use areas	TBD	Varies	As Needed	In-house	Continue to collect information from visitor passes and CLEO records/observations/corrective actions to determine the possible impacts created from public use.					
5	Revise and maintain visitor map	TBD	Varies	As Needed	In-house	A surplus of the 2008 BMGR West informational brochure/map is available through the permitting office or Range Management Department; the brochure/map outlines public use rules and open/closed areas; publication of a revised map will be completed when existing sources are exhausted.	$3,000	$3,000	$3,000	$3,000	$3,000
5	Retain a minimum of four full-time CLEO positions	Annual	TBD	Annual	In-house	Four full-time Conservation Law Enforcement Officers have been filled.					
5	Public outreach	Annual	Varies	Annual	In-house	Support public awareness efforts to educate MCAS Yuma employees and the Public concerning natural and cultural resources, historic preservation, and conservation activities.					
5	Compile recreation-use statistics, analyze patterns, ascertain where use is heavy to identify areas of resource concern	Annual	TBD	Annual	In-house	This is on-going and closely monitored.					
8	Evaluate the effects of non-game species collection on wildlife, habitat, and other resources; limit or restrict collection activities within the authority of state law	Annual	In-kind	Annual	In-house, Interagency	Determine as needed and as funding is available.					
Manage Realty Property											
10, 17	Cooperate with ADOT, BP, and utility companies regarding proposed actions within existing utility/transportation corridors	As Needed	Varies	As Needed	Interagency	Continue an open dialogue with partnering agencies at BEC and IEC meetings; the RMD works in cooperation with the BEC, ICC, MOG, Pronghorn recovery Team, and local, state, and federal governments to revise and improve management actions and policies.					
Perimeter Land Use											
17	Monitor illegal immigration, trafficking, and border-related law enforcement to anticipate how BMGR resources may be affected	As Needed	Varies	As Needed	In-house, Interagency	Continue coordinating with law enforcement authorities and sharing of anecdotal evidence of border-related impacts.					
						BUDGET TOTALS BY YEAR ($)	**630,780**	**240,113**	**369,852**	**249,626**	**254,413**

[1] INRMP Resource Management Element addressed
[2] Fulfill requirement of Resource Management Element
[3] Year of funding and completion of action
[4] Estimate of required funding amount to complete project
[5] How often action will occur
[6] Responsible parties for completing the action
*May require further NEPA review and/or Section 106 consultation

CHAPTER 11 REFERENCES

11.1 Standard References (Applicable to all AF installations)

- AFMAN 32-7003, *Environmental Conservation*
- Sikes Act
- eDASH Natural Resources Program Page
- Natural Resources Playbook
- DoDI 4715.03, *Natural Resources Conservation Program*
- AFI 32-1015, *Integrated Installation Planning*
- AFI 32-10112, *Installation Geospatial Information and Services (IGI&S)*

11.2 Installation References

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32 Code of Federal Regulations (CFR). National Defense, 1 March 2018. Available at http://federal.elaws.us/cfr/title32.

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50.13 Code of Federal Regulations (CFR). List of Migratory Birds, 5 April 1985. Available at https://www.gpo.gov/fdsys/pkg/CFR-2000-title50-vol1/pdf/CFR-2000-title50-vol1-sec10-13.pdf.

5 U.S. Code (U.S.C.) § 551 et seq. Administrative Procedure Act Available at https://www.law.cornell.edu/uscode/text/5/part-I/chapter-5/subchapter-II.

7 U.S. Code (U.S.C.) § 136 et seq. Federal Insecticide, Fungicide, and Rodenticide Act of 1996. Available at https://www.law.cornell.edu/uscode/text/7/136.

8 U.S. Code (U.S.C.) § 1103. Aliens and Nationality. Available at https://www.gpo.gov/fdsys/granule/USCODE-2010-title8/USCODE-2010-title8-chap12-subchapI-sec1103.

10 U.S. Code (U.S.C.) § 807(7)(b). Uniform Code of Military Justice. Available at http://www.ucmj.us/sub-chapter-2-apprehension-and-restraint/807-article-7-apprehension.

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16 U.S. Code (U.S.C.) §§ 668dd-668ee. National Wildlife Refuge System Administration Act. Available at https://www.law.cornell.edu/uscode/text/16/668dd.

16 U.S. Code (U.S.C.) § 670a et seq. The Sikes Act Improvement Act. Available at https://www.fws.gov/fisheries/sikes_act/documents/DoD%20Sikes%20Act%20Guidance--8%20October.pdf.

16 U.S. Code (U.S.C.) § 1131 et seq.. Wilderness Act of 1964. Available at https://wilderness.nps.gov/RM41/2_Authority/1964_WildernessAct16_USC_1131_1136.pdf.

16 U.S. Code (U.S.C.) §§ 1331-1340. Wild Free-Roaming Horses and Burros Act of 1971, as amended by the Federal Land Policy and Management Act of 1976. Available at https://www.law.cornell.edu/uscode/text/16/chapter-30.

16 U.S. Code (U.S.C.) § 1531 et seq. Endangered Species Act of 1973 (as ameded in 1988). Available at http://uscode.house.gov/view.xhtml?path=/prelim@title16/chapter35&edition=prelim.

16 U.S.Code (U.S.C.) § 4321 et seq. National Energy Policy Act.

18 U.S. Code (U.S.C.) § 13. Assimilative Crimes Act of 1948. Available at https://www.law.cornell.edu/uscode/text/18/13.

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33 U.S. Code (U.S.C.) § 1251 et seq. Clean Water Act. Available at https://www.law.cornell.edu/uscode/text/33/1251.

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CHAPTER 12 ACRONYMS

12.1 Standard Acronyms (Applicable to all USAF installations)

- eDASH Acronym Library
- Natural Resources Playbook – Acronym Section
- U.S. EPA Terms & Acronyms

12.2 Installation Acronyms

ADC	Air Defense Command
ADOT	Arizona Department of Transportation
AFAF	Air Force Auxiliary Field
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFI	Air Force Instruction
AGFD	Arizona Game and Fish Department
AGL	Above Ground Level
AHAS	Avian Hazard Advisory System
ALF	Auxiliary Landing Field
AML	Appropriate Management Level
AMSL	Above Mean Sea Level
ANG	Air National Guard
ARNG	Army National Guard
ARS	Arizona Revised Statutes
ASSP	Arizona Site Stewards Program
ATP	Army Techniques Publication
AUX	Auxiliary Field
AZ	Arizona
AZDA	Arizona Department of Agriculture
BASH	Bird/Wildlife Aircraft Strike Hazard
BEC	Barry M. Goldwater Range Executive Council
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BMGR	Barry M. Goldwater Range
BP	U.S. Border Patrol
CBP	U.S. Customs & Border Protection
CLEO	Conservation Law Enforcement Officer
CRP	Comprehensive Range Plan
CCSM	Community Climate System Model
CEMML	Center for Environmental Management of Military Lands
CSU	Colorado State University
DoD	(U.S.) Department of Defense
DOI	Department of the Interior
DZ	Drop Zone
EIS	Environmental Impact Statement
EMS	Environmental Management System
EO	Executive Order

EOD	Explosive Ordnance Disposal
ESA	Endangered Species Act of 1973
ESM	Environmental Sciences Management
ETAC	East Tactical Range
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act of 1996
FLPMA	Federal Land Policy and Management Act of 1976
FONSI	Finding of No Significant Impact
FTHL	Flat-Tailed Horned Lizard
FW	Fighter Wing
FWO	Federal Wildlife Officers
FY	Fiscal Year
GEOFidelis	Marine Corps Installation Geospatial Information and Services
GDD	Growing Degree Days
GIS	Geographic Information System
GPS	Global Positioning System
HMA	Herd Management Area
ICRMP	Integrated Cultural Resources Management Plan
IEC	Intergovernmental Executive Committee
INRMP	Integrated Natural Resources Management Plan
IPCC	Intergovernmental Panel on Climate Change
IPCC-CMIPP5	IPCC Coupled Model Intercomparison Project Phase 5
ISI-MIP	Inter-Sectoral Impact Model Intercomparison Project
IPMP	Integrated Pest Management Plan
KNOZ	The new F-35 Auxiliary Landing Zone is known as KNOZ
MBTA	Migratory Bird Treaty Act of 1918
MCAS	Marine Corps Air Station
MCO	Marine Corps Order
MLWA	Military Lands Withdrawal Act of 1999
MOU	Memorandum of Understanding
MP	Management Policy
NCAR	National Center for Atmospheric Research
NEPA	National Environmental Policy Act of 1969
NIPRNet	Non-classified Internet Protocol Router Network
NM	National Monument
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NRM	Natural Resource Manager
NTAC	North Tactical Range
NWR	National Wildlife Refuge
OHV	Off-Highway Vehicle
P.L.	Public Law
PRECIP	Annual Average Precipitation
PRIA	Public Rangeland Improvement Act of 1978
RCP	Representative Concentration Pathway
RMCP	Range Munitions Consolidation Points
RMD	Range Management Department
RMO	Range Management Office
RMS	Rangewide Management Strategy
ROD	Record of Decision
RS	Resource-Specific

SGCN	Species of Greatest Conservation Need
SOP	Standard Operating Procedure
SR	State Route
STAC	South Tactical Range
SWAP	State Wildlife Action Plan
TAC	Tactical
TAVE	Annual Average Temperature
TMAX	Annual Average Maximum Temperature
TMIN	Annual Average Minimum Temperature
TEK	Traditional Ecological Knowledge
UA	University of Arizona
UDA	Undocumented Alien
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USMC	U.S. Marine Corps
USN	U.S. Department of the Navy
USNVC	U.S. National Vegetation Classification Standard
UTC	Urban Target Complex
WFMP	Wildland Fire Management Plan
WFRHBA	Wild Free-Roaming Horses and Burros Act of 1971
WSM	Wildland Support Modules

CHAPTER 13 DEFINITIONS

13.1 Standard Definitions (Applicable to all USAF installations)

- Natural Resources Playbook – Definitions Section

CHAPTER 14 APPENDICES

14.1 Standard Appendices

Appendix A. Annotated Summary of Key Legislation Related to Design and Implementation of the INRMP

FEDERAL PUBLIC LAWS AND EXECUTIVE ORDERS	
National Defense Authorization Act of 1989, Public Law (P.L.) 101-189; Volunteer Partnership Cost-Share Program	Amends two Acts and establishes volunteer and partnership programs for natural and cultural resources management on DoD lands.
Defense Appropriations Act of 1991, P.L. 101-511; Legacy Resource Management Program	Establishes the "Legacy Resource Management Program" for natural and cultural resources. Program emphasis is on inventory and stewardship responsibilities of biological, geophysical, cultural, and historic resources on DoD lands, including restoration of degraded or altered habitats.
EO 11514, *Protection and Enhancement of Environmental Quality*	Federal agencies shall initiate measures needed to direct their policies, plans, and programs to meet national environmental goals. They shall monitor, evaluate, and control agency activities to protect and enhance the quality of the environment.
EO 11593, *Protection and Enhancement of the Cultural Environment*	All Federal agencies are required to locate, identify, and record all cultural resources. Cultural resources include sites of archaeological, historical, or architectural significance.
EO 11987, *Exotic Organisms*	Agencies shall restrict the introduction of exotic species into the natural ecosystems on lands and waters which they administer.
EO 11988, *Floodplain Management*	Provides direction regarding actions of Federal agencies in floodplains, and requires permits from state, territory and Federal review agencies for any construction within a 100-year floodplain and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for acquiring, managing and disposing of Federal lands and facilities.
EO 11989, *Off-Road vehicles on Public Lands*	Installations permitting off-road vehicles to designate and mark specific areas/trails to minimize damage and conflicts, publish information including maps, and monitor the effects of their use. Installations may close areas if adverse effects on natural, cultural, or historic resources are observed.
EO 11990, *Protection of Wetlands*	Requires Federal agencies to avoid undertaking or providing assistance for new construction in wetlands unless there is no practicable alternative, and all practicable measures to minimize harm to wetlands have been implemented and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; and (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.
EO 12088, *Federal Compliance with Pollution Control Standards*	This EO delegates responsibility to the head of each executive agency for ensuring all necessary actions are taken for the prevention, control, and abatement of environmental pollution. This order gives the U.S. Environmental Protection Agency (US EPA) authority to conduct reviews

FEDERAL PUBLIC LAWS AND EXECUTIVE ORDERS	
	and inspections to monitor federal facility compliance with pollution control standards.
EO 12898, *Environmental Justice*	This EO requires certain federal agencies, including the DoD, to the greatest extent practicable permitted by law, to make environmental justice part of their missions by identifying and addressing disproportionately high and adverse health or environmental effects on minority and low-income populations.
EO 13112, *Exotic and Invasive Species*	To prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.
EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*	The USFWS has the responsibility to administer, oversee, and enforce the conservation provisions of the Migratory Bird Treaty Act, which includes responsibility for population management (e.g., monitoring), habitat protection (e.g., acquisition, enhancement, and modification), international coordination, and regulations development and enforcement.
United States Code	
Animal Damage Control Act (7 U.S.C. § 426-426b, 47 Stat. 1468)	Provides authority to the Secretary of Agriculture for investigation and control of mammalian predators, rodents, and birds. DoD installations may enter into cooperative agreements to conduct animal control projects.
Bald and Golden Eagle Protection Act of 1940, as amended; 16 U.S.C. 668-668c	This law provides for the protection of the bald eagle (the national emblem) and the golden eagle by prohibiting, except under certain specified conditions, the taking, possession and commerce of such birds. The 1972 amendments increased penalties for violating provisions of the Act or regulations issued pursuant thereto and strengthened other enforcement measures. Rewards are provided for information leading to arrest and conviction for violation of the Act.
Clean Air Act, (42 U.S.C. § 7401– 7671q, July 14, 1955, as amended)	This Act, as amended, is known as the Clean Air Act of 1970. The amendments made in 1970 established the core of the clean air program. The primary objective is to establish Federal standards for air pollutants. It is designed to improve air quality in areas of the country which do not meet federal standards and to prevent significant deterioration in areas where air quality exceeds those standards.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (Superfund) (26 U.S.C. § 4611–4682, P.L. 96-510, 94 Stat. 2797), as amended	Authorizes and administers a program to assess damage, respond to releases of hazardous substances, fund cleanup, establish clean-up standards, assign liability, and other efforts to address environmental contaminants. Installation Restoration Program guides cleanups at DoD installations.
Endangered Species Act (ESA) of 1973, as amended; P.L. 93-205, 16 U.S.C. § 1531 et seq.	Protects threatened, endangered, and candidate species of fish, wildlife, and plants and their designated critical habitats. Under this law, no federal action is allowed to jeopardize the continued existence of an endangered or threatened species. The ESA requires consultation with the USFWS and the NOAA Fisheries (National Marine Fisheries Service) and the preparation of a biological evaluation or a biological assessment may be required when such species are present in an area affected by government activities.
Federal Aid in Wildlife Restoration Act of 1937 (16	Provides federal aid to states and territories for management and restoration of wildlife. Fund derives from sports tax on arms and

FEDERAL PUBLIC LAWS AND EXECUTIVE ORDERS	
U.S.C. § 669–669i; 50 Stat. 917) (Pittman-Robertson Act)	ammunition. Projects include acquisition of wildlife habitat, wildlife research surveys, development of access facilities, and hunter education.
Federal Environmental Pesticide Act of 1972	Requires installations to ensure pesticides are used only in accordance with their label registrations and restricted-use pesticides are applied only by certified applicators.
Federal Land Use Policy and Management Act, 43 U.S.C. § 1701–1782	Requires management of public lands to protect the quality of scientific, scenic, historical, ecological, environmental, and archaeological resources and values; as well as to preserve and protect certain lands in their natural condition for fish and wildlife habitat. This Act also requires consideration of commodity production such as timbering.
Federal Noxious Weed Act of 1974, 7 U.S.C. § 2801–2814	The Act provides for the control and management of non-indigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health.
Federal Water Pollution Control Act (Clean Water Act [CWA]), 33 U.S.C. §1251–1387	The CWA is a comprehensive statute aimed at restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. Primary authority for the implementation and enforcement rests with the US EPA.
Fish and Wildlife Conservation Act (16 U.S.C. § 2901–2911; 94 Stat. 1322, PL 96-366)	Installations encouraged to use their authority to conserve and promote conservation of nongame fish and wildlife in their habitats.
Fish and Wildlife Coordination Act (16 U.S.C. § 661 et seq.)	Directs installations to consult with the USFWS, or state or territorial agencies to ascertain means to protect fish and wildlife resources related to actions resulting in the control or structural modification of any natural stream or body of water. Includes provisions for mitigation and reporting.
Lacey Act of 1900 (16 U.S.C. § 701, 702, 32 Stat. 187, 32 Stat. 285)	Prohibits the importation of wild animals or birds or parts thereof, taken, possessed, or exported in violation of the laws of the country or territory of origin. Provides enforcement and penalties for violation of wildlife related Acts or regulations.
Leases: Non-excess Property of Military Departments, 10 U.S.C. § 2667, as amended	Authorizes DoD to lease to commercial enterprises Federal land not currently needed for public use. Covers agricultural outleasing program.
Migratory Bird Treaty Act 16 U.S.C. § 703–712	The Act implements various treaties for the protection of migratory birds. Under the Act, taking, killing, or possessing migratory birds is unlawful without a valid permit.
National Environmental Policy Act of 1969 (NEPA), as amended; P.L. 91-190, 42 U.S.C. § 4321 et seq.	Requires federal agencies to utilize a systematic approach when assessing environmental impacts of government activities. Establishes the use of environmental impact statements. NEPA proposes an interdisciplinary approach in a decision-making process designed to identify unacceptable or unnecessary impacts on the environment. The Council of Environmental Quality (CEQ) created Regulations for Implementing the National Environmental Policy Act [40 Code of Federal Regulations (CFR) Parts 1500– 1508], which provide regulations applicable to and binding on all Federal agencies for implementing the procedural provisions of NEPA, as amended.
National Historic Preservation Act, 16 U.S.C. § 470 et seq.	Requires federal agencies to take account of the effect of any federally assisted undertaking or licensing on any district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places (NRHP). Provides for the nomination, identification

FEDERAL PUBLIC LAWS AND EXECUTIVE ORDERS	
	(through listing on the NRHP), and protection of historical and cultural properties of significance.
National Trails Systems Act (16 U.S.C. § 1241–1249)	Provides for the establishment of recreation and scenic trails.
National Wildlife Refuge Acts	Provides for establishment of National Wildlife Refuges through purchase, land transfer, donation, cooperative agreements, and other means.
National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd–668ee)	Provides guidelines and instructions for the administration of Wildlife Refuges and other conservation areas.
Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. § 3001–13; 104 Stat. 3042), as amended	Established requirements for the treatment of Native American human remains and sacred or cultural objects found on Federal lands. Includes requirements on inventory, and notification.
Rivers and Harbors Act of 1899 (33 U.S.C. § 401 et seq.)	Makes it unlawful for the USAF to conduct any work or activity in navigable waters of the United States without a federal permit. Installations should coordinate with the U.S. Army Corps of Engineers (USACE) to obtain permits for the discharge of refuse affecting navigable waters under National Pollutant Discharge Elimination System (NPDES) and should coordinate with the USFWS to review effects on fish and wildlife of work and activities to be undertaken as permitted by the USACE.
Sale of certain interests in land, 10 U.S.C. § 2665	Authorizes sale of forest products and reimbursement of the costs of management of forest resources.
Soil and Water Conservation Act (16 U.S.C. § 2001, P.L. 95-193)	Installations shall coordinate with the Secretary of Agriculture to appraise, on a continual basis, soil/water-related resources. Installations will develop and update a program for furthering the conservation, protection, and enhancement of these resources consistent with other federal and local programs.
Sikes Act (16 U.S.C. § 670a–670l, 74 Stat. 1052), as amended	Provides for the cooperation of DoD, the Departments of the Interior (USFWS), and the State Fish and Game Department in planning, developing, and maintaining fish and wildlife resources on a military installation. Requires development of an INRMP and public access to natural resources and allows collection of nominal hunting and fishing fees. NOTE: AFMAN 32-7003 3.11 *INRMP Implementation*. In accordance with DoDI 4715.03, installations will use professionally trained natural resources management personnel with a degree in the natural sciences to develop and implement the installation INRMP. (T-0). 3.9.1. Outsourcing Natural Resources Management. As stipulated in the Sikes Act, 16 U.S.C. § 670 et. seq., the Office of Management and Budget Circular No. A-76, Performance of Commercial Activities, August 4, 1983 (Revised May 29, 2003) does not apply to the development, implementation and enforcement of INRMPs. Activities that require the exercise of discretion in making decisions regarding the management and disposition of government owned natural resources are inherently governmental. When it is not practicable to utilize DoD personnel to perform inherently governmental natural resources management duties, they may, in accordance with the Sikes Act, obtain inherently governmental services from federal agencies having responsibilities for the conservation and management of natural resources.

FEDERAL PUBLIC LAWS AND EXECUTIVE ORDERS	
DoD Policy, Directives, and Instructions	
DoD Instruction 4150.07 *DoD Pest Management Program* dated 29 May 2008	Implements policy, assigns responsibilities, and prescribes procedures for the DoD Integrated Pest Management Program.
DoD Instruction 4715.1, *Environmental Security*	Establishes policy for protecting, preserving, and (when required) restoring and enhancing the quality of the environment. This instruction also ensures environmental factors are integrated into DoD decision-making processes that could impact the environment, and are given appropriate consideration along with other relevant factors.
DoD Instruction (DoDI) 4715.03, *Natural Resources Conservation Program*	Implements policy, assigns responsibility, and prescribes procedures under DoDI 4715.1 for the integrated management of natural and cultural resources on property under DoD control.
OSD Policy Memorandum – 17 May 2005 – *Implementation of Sikes Act Improvement Amendments: Supplemental Guidance Concerning Leased Lands*	Provides supplemental guidance for implementing the requirements of the Sikes Act in a consistent manner throughout DoD. The guidance covers lands occupied by tenants or lessees or being used by others pursuant to a permit, license, right of way, or any other form of permission. INRMPs must address the resource management on all lands for which the subject installation has real property accountability, including leased lands. Installation commanders may require tenants to accept responsibility for performing appropriate natural resource management actions as a condition of their occupancy or use, but this does not preclude the requirement to address the natural resource management needs of these lands in the installation INRMP.
OSD Policy Memorandum – 1 November 2004 – *Implementation of Sikes Act Improvement Act Amendments: Supplemental Guidance Concerning INRMP Reviews*	Emphasizes implementing and improving the overall INRMP coordination process. Provides policy on scope of INRMP review, and public comment on INRMP review.
OSD Policy Memorandum – 10 October 2002 – *Implementation of Sikes Act Improvement Act: Updated Guidance*	Provides guidance for implementing the requirements of the Sikes Act in a consistent manner throughout DoD and replaces the 21 September 1998 guidance Implementation of the Sikes Act Improvement Amendments. Emphasizes implementing and improving the overall INRMP coordination process and focuses on coordinating with stakeholders, reporting requirements and metrics, budgeting for INRMP projects, using the INRMP as a substitute for critical habitat designation, supporting military training and testing needs, and facilitating the INRMP review process.
USAF Instructions and Directives	
32 CFR Part 989, as amended, and AFI 32-7061, Environmental Impact Analysis Process (EIAP)	Provides guidance and responsibilities in the EIAP for implementing INRMPs. Implementation of an INRMP constitutes a major federal action and therefore is subject to evaluation through an Environmental Assessment or an Environmental Impact Statement.
AFI 32-1015, *Integrated Installation Planning*	This publication establishes a comprehensive and integrated planning framework for development/redevelopment of Air Force installations..
AFMAN 32-7003, *Environmental Conservation*	This Manual implements AFPD 32-70 and DoDI 4710.1, *Archaeological and Historic Resources Management.* It explains how to manage cultural resources on USAF property in compliance with Federal, state, territorial, and local standards.
AFI 32-10112 *Installation Geospatial Information and Services (IGI&S)*	This instruction implements Department of Defense Instruction (DoDI) 8130.01, Installation Geospatial Information and Services (IGI&S) by identifying the requirements to implement and maintain an Air Force

FEDERAL PUBLIC LAWS AND EXECUTIVE ORDERS	
	Installation Geospatial Information and Services program and Air Force Policy Directive (AFPD) 32-10 Installations and Facilities.
AFPD 32-70, *Environmental Quality*	Outlines the USAF mission to achieve and maintain environmental quality on all USAF lands by cleaning up environmental damage resulting from past activities, meeting all environmental standards applicable to present operations, planning its future activities to minimize environmental impacts, managing responsibly the irreplaceable natural and cultural resources it holds in public trust and eliminating pollution from its activities wherever possible. AFPD 32-70 also establishes policies to carry out these objectives.
Policy Memo for Implementation of Sikes Act Improvement Amendments, HQ USAF Environmental Office (USAF/ILEV) on January 29, 1999	Outlines the USAF interpretation and explanation of the Sikes Act and Improvement Act of 1997.

14.2 Installation Appendices

Appendix B BMGR East and West 2012–2017 INRMP Management Elements and Status of Action Items

The action items proposed for BMGR East (Table A.15-1) and West (Table A.15-2) in the 2012 BMGR INRMP for 2012–2017, and their status/progress as of early 2018, are provided in Appendix B. Action items are listed by management element. Note that not every management element has proposed action items in every five-year INRMP cycle.

CHAPTER 15 ASSOCIATED PLANS

15.1 Tab 1 – Wildland Fire Management Plan

15.2 Tab 2 – Bird/Wildlife Aircraft Strike Hazard (BASH) Plan

15.3 Tab 3 – Golf Environmental Management (GEM) Plan

15.4 Tab 4 – Integrated Cultural Resources Management Plan (ICRMP)

15.5 Tab 5 – Integrated Pest Management Plan (IPMP)

Table A.15-1: Action items, listed by management element number and title, proposed for BMGR East in the 2012–2017 INRMP, and action item status/progress as of early 2018.

Action Plan Item	Status	Progress by 2018
1—Resource Inventory and Monitoring		
Monitor and control invasive species	Ongoing	Initiated cleaning of drags to prevent spread of invasive species, mapping of invasive species, and physical and chemical removal of invasive species
Monitor 92 vegetation plots in several plant communities	Ongoing	Plots have been checked at five-year intervals and will continue to be checked on the same schedule
Desert tortoise surveys	Ongoing	Landscape-level habitat model developed to determine likelihood of desert tortoise presence (Grandmaison 2012)
Raptor management surveys and monitoring	Ongoing	AGFD 2013–2015 study to evaluate airborne military activities on golden eagles, breeding bird survey (2012–2014), avian species survey conducted by Tunista Service and Chiulista Services 2012–2016 for the Annual BASH Summary Report
Bird surveys	Ongoing	Breeding bird survey (2012–2014), avian species survey conducted by Tunista Service and Chiulista Services 2012–2016 for the Annual BASH Summary Report, total of 1253 bird surveys from 2012–2016
Support AGFD surveys for game ungulates	Ongoing	Annual deer surveys; bighorn sheep surveys (2014, 2017)
Support AGFD surveys for gamebirds	Ongoing	Game bird surveys conducted on an annual basis
Collaborate with AGFD to identify/maintain important wildlife connectivity corridors at BMGR East	Ongoing	Desert tortoise research identified wash systems as important movement corridors
Kit fox population monitoring	Ongoing	Completed kit fox population monitoring using scent stations (2013, 2016)
Bat surveys; evaluate, monitor and protect important bat roosts	Ongoing	Bat monitoring study (Mixan et al. 2016), 2012–2014 study (Piorkowski et al.) to determine potential conflict with bats and military mission
CFPO survey (low priority)	Ongoing	Repeated surveys spanning the past 20 years on The BMGR East
Weather stations and rain gauges	Ongoing	BMGR East implemented network of communication grade weather systems in 2011; BMGR West uses manual-download weather stations
Monitor use of wildlife waters	Ongoing	Wildlife cameras used to record species which use wildlife waters (2008–2012)
Medium and low priority actions as resources allow	Not initiated	
Vegetation mapping	Ongoing	The BMGR West completed vegetation mapping in 2014 (Malusa and Sundt 2015), The BMGR East initiated mapping in 2003 and plans to complete mapping by FY 2019
Support special studies to address specific management issues, such as invasives, species of concern, climate change, etc.	Ongoing	Continuing Research of Impacts associated with Drag Roads
Implement cultural resource survey and monitoring requirements for INRMP – related actions	Ongoing	Completed cultural resources survey for a renewable energy project for MCAS Yuma in 2013 and a number of archeological surveys at BMGR West from 2013–2016
2—Special Natural/Interest Areas		

Identify and evaluate other possible Special Natural / Interest Areas	Not initiated	Project to be initiated in 2021
3—Motorized Access and Non-Roaded Area Management		
Close selected roads to public access where an agency mission or resource protection issues conflict with public use	Ongoing	Access restrictions have been imposed in the past due to security, safety, cultural or environmental reasons and will continue to be imposed as required
4—Camping and Stay Limits		
Assess benefits and effects of establishing designated camping areas and implement a decision based on findings	Initiated/incomplete	Documented known camping areas to detect changes by repeat photography
5—Recreation Services and Use Supervision		
Revise public visitation maps and rules for public education and recreation use; would inform the public about road restrictions and resource sensitivities	Ongoing	Annual process which has been conducted for a number of years and will continue to as restrictions change
Public outreach	Ongoing	Public awareness projects have been used to educate base personnel and the public about activities at The BMGR
Hire law enforcement officers to be retained and dedicated to the BMGR East; interim measure consists of contract security guards with detention authority	Initiated/incomplete	One CLEO started in October 2017 and a second will begin in FY 2019
Install signs, gates, and fences to support road infrastructure and public access	Ongoing	Ongoing annual process which will continue to update signage as public access and road infrastructure changes
Compile recreation use statistics; analyze patterns, identify heavily used areas; monitor those areas to identify and resource concerns	Initiated/incomplete	Deployed traffic counters at gate entry areas; new iSportsman application will aid in recreation use statistics
7—Wood cutting, Gathering, and Firewood Use, and Collection of Native Plants		
Monitor native wood supplies in high-use areas; restrict wood collection if resource conditions dictate	Ongoing	Documented known camping areas to detect changes by repeat photography
10—Utility/Transportations Corridors		
Cooperate with ADOT, BLM, U.S. Border patrol, and utility companies regarding proposed actions within existing utility/transportation corridors	Ongoing	Cooperate with partners on all utility/transportation corridors
Coordinate with CE Real Property to restrict future utility and transportation corridors to the existing State Route 85 and railroad rights of way	Ongoing	Coordinate to ensure proper procedures are implemented
11—General Vegetation, Wildlife, Wildlife Habitat, and Wildlife Waters		
Monitor and control invasive species	Ongoing	Initiated cleaning of drags to prevent spread of invasive species, mapping of invasive species, and physical and chemical removal of invasive species
Habitat restoration[1]	Ongoing	Implement as needed and based on priority level and type of threat
Evaluate benefits and adverse effects of wildlife waters	Ongoing	Water quality tested by USGS (2013–2016), camera trapping program (2008–2012)
Develop and implement procedures to control trespass livestock	Ongoing	Fences have been established around the BMGR perimeter

Allow for the maintenance and repair of existing water developments[1]	Ongoing	AGFD has constructed catchments and refills them during periods of extreme drought
12—Special Status Species		
Participate and implement actions per the Sonoran Pronghorn Recovery Plan	Ongoing	Established semi-captive breeding program at the Cabeza Prieta NWR (2003) and at Kofa NWR (2011); established a second population within historical range at BMGR East, monitoring program established on ranges when EOD operations or weapon use is expected
13—Soil and Water Resources		
Evaluate erosion conditions of range roads; repair or temporarily restrict use[1]	Ongoing	USGS developed erosion vulnerability model from vehicle use at BMGR West (2014), implemented 3D cameras to monitor erosion across range
Evaluate erosion problems in specific areas, develop plans for repair	Ongoing	Installed hay bales and straw waddles to reduce erosion
Monitor water table levels	Ongoing	Annual Gila Bend contractor requirement
14—Air Resources		
Control excessive fugitive dust at permitted construction sites and recreation activity areas	Ongoing	All county air quality regulations are followed
16—Wildfire Management		
Complete and subsequently implement Fire Management Plan	Initiated/incomplete	56 RMO to complete Wildland Fire Management Plan in 2018
17—Perimeter Land Use, Encroachment, and Regional Planning		
Participate in local and regional planning and monitoring land use patterns	Ongoing	2018 Public Report provides opportunity for public input, public allowed to participate in development or review of environmental assessments or impact statements
Monitor illegal immigration, trafficking, and border-related law enforcement to anticipate how the BMGR resources may be affected	Ongoing	BEC meetings held six times a year regarding illegal traffic and patrol impacts on natural resources in the BMGR region; law enforcement required to complete the Range Access and Safety Training Program

[1] May require further NEPA review and/or Section 106 consultation.

Table A.15-2: Action items, listed by management element number and title, proposed for BMGR West in the 2012–2017 INRMP, and action item status/progress as of early 2018.

Action Plan Item	Status	Progress by 2018
1—Resource Inventory and Monitoring		
FTHL Joint Strike Fighter Impact Study	Completed	This action is completed
Complete range wide vegetation map	Completed	This action is completed
Identify and monitor vegetation plots in several plant communities	Ongoing	Working with National Park Service to control invasive species
Reptile, small mammal, and amphibian surveys and monitoring	Ongoing	(1) Establish a repeatable baseline monitoring methodology that will capture the diversity of small mammals, reptiles, and amphibians; (2) develop potential distribution maps captured wildlife, and; (3) provide recommendations to monitoring efforts and natural resource stewardship (will continue through FY 2018, 2019)
General bird surveys	Not initiated	New protocol under development
Bat surveys	Ongoing	Assist AGFD in conducting bat surveys at BMGR-West
Collaborate with AGFD to identify and maintain important wildlife connectivity corridors at BMGR West	Not initiated	Collaborate with AGFD and partner agencies to identify and maintain important wildlife connectivity corridors at BMGR West
Installation and maintenance of weather stations and rain gauges	Ongoing	Upgrade existing weather stations to wireless communication with Luke AFB
Support special studies to address specific management issues, such as invasives, species of concern, climate change, etc.	Ongoing	This is an ongoing action
Implement cultural resource survey and monitoring requirements for INRMP—related actions	Ongoing	Cultural resource surveys and monitoring will continue
Develop and implement systems to monitor the effectiveness of compliance actions	Ongoing	This is an ongoing action
Develop a plan for determining the limits-of-acceptable change for recreational, natural, and cultural resources	Not initiated	Use baseline survey data to determine the degree of change and develop a plan appropriate to the findings
Construct adaptive management strategies for maintaining acceptable limits of change	Not initiated	Consider existing baseline survey data and regional concerns to determine the need for the implementing of adaptive management strategies
Annual FTHL occupancy surveys	Ongoing	These surveys will continue
3—Motorized Access and Non-Roaded Area Management		
Temporarily close selected roads to public access where an agency mission or resource protection issues conflict with public use	Ongoing	This action is ongoing and as needed
Evaluate site-specific proposals for future need and impacts of developing additional roads for agency purposes[1]	Ongoing	At this time there are no plans for any new roads for agency use
Implement site specific planning for two bypass roads that would reroute vehicle traffic around the northwest corner of the Cabeza Prieta NWR	Completed	This action is completed
4—Camping and Stay Limits		
Assess benefits and effects of establishing designated camping areas and implement a decision based on the findings	Ongoing	Continue to collect information from visitor passes and CLEO records/observations/corrective actions to determine the possible impacts created form public use

Action Plan Item	Status	Progress by 2018
5—Recreation Services and Use Supervision		
Develop a plan for determining the limits-of-acceptable change for recreational, natural, and cultural resources	Not initiated	Use baseline survey data to determine the degree of change and develop a plan appropriate to the findings
Revise visitor map	Ongoing	This action is scheduled during the next five years
Public outreach	Ongoing	Support public awareness efforts to educate MCAS Yuma employees and the public concerning natural, and cultural resources, historic preservation, and conservation activities
Install signs, gates and fences to support road infrastructure and public access	Ongoing	Install signs as needed to identify restricted areas, range boundaries, range entry points, along perimeters, road intersections, and ground support areas
Compile recreation use statistics; analyze patterns, identify heavily used areas; monitor those areas to identify and resource concerns	Ongoing	This is on-going and closely monitored
7—Wood cutting, Gathering, and Firewood Use, and Collection of Native Plants		
Develop a plan for determining the limits-of-acceptable change for recreational, natural, and cultural resources	Not initiated	Use baseline survey data to determine the degree of change and develop a plan appropriate to the findings
8— Hunting		
Develop a plan for determining the limits-of-acceptable change for recreational, natural, and cultural resources	Not initiated	Use baseline survey data to determine the degree of change and develop a plan appropriate to the findings
10—Utility/Transportations Corridors		
Cooperate with ADOT, U.S. Border Patrol, and utility companies regarding proposed actions within existing utility/transportation corridors	Ongoing	Continue an open dialogue with partnering agencies at BEC and IEC meetings, the RMD works in cooperation with the BEC, ICC, MOG, Pronghorn Recovery Team, and local, state, and federal governments to revise and improve management actions and policies
11—General Vegetation, Wildlife, Wildlife Habitat, and Wildlife Waters		
Develop a plan for determining the limits-of-acceptable change for recreational, natural, and cultural resources	Not initiated	Use baseline survey data to determine the degree of change and develop a plan appropriate to the findings
Allow maintenance and development of existing water sources supporting wildlife	Ongoing	Continue to work with AGFD to monitor and maintain existing network of wildlife waters at BMGR-West
Partner with U.S. Border Patrol to identify and implement the habitat restoration	Ongoing	Collaborate with local U.S. Border Patrol offices to implement maintenance and repair best management practices as outlined in CBP's 2012 EA (Department of Homeland Security 2012, https://nemo.cbp.gov/sbi/az_timr_final_ea.pdf
Support AGFD installation of up to a total of six high-priority wildlife waters[1]	Ongoing	Determine as needed and available funding
12—Special Status Species		
Participate and implement actions per the Sonoran Pronghorn Recovery Plan	Ongoing	Support Sonoran pronghorn recovery actions as stipulated in the Biological Opinion, Recovery Plan, or as determined by the Interagency Recovery Team

Action Plan Item	Status	Progress by 2018
13—Soil and Water Resources		
Comprehensive erosion assessment to prioritize the sites with severe erosion, and examine available engineering management practice that can mitigate erosion	Ongoing	This is on-going and closely monitored
16—Wildfire Management		
Complete and subsequently implement fire management plan	Ongoing	BMGR-West Fire Management Plan will be completed in FY 2018
17—Perimeter Land Use, Encroachment, and Regional Planning		
Monitor illegal immigration, trafficking, and border-related law enforcement to anticipate how the BMGR resources may be affected	Ongoing	Continue coordinating with law enforcement authorities and sharing of anecdotal evidence of border-related impacts